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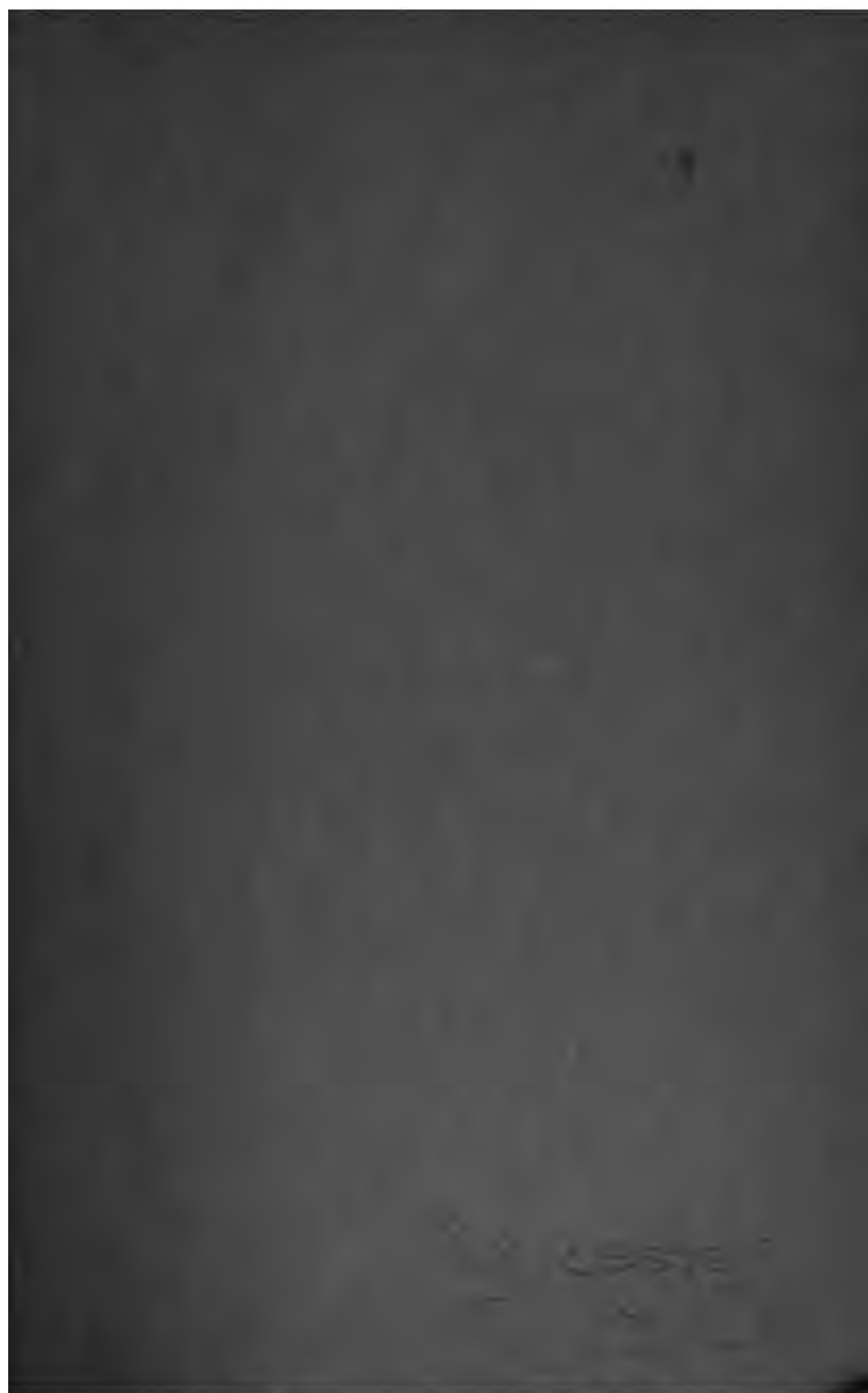
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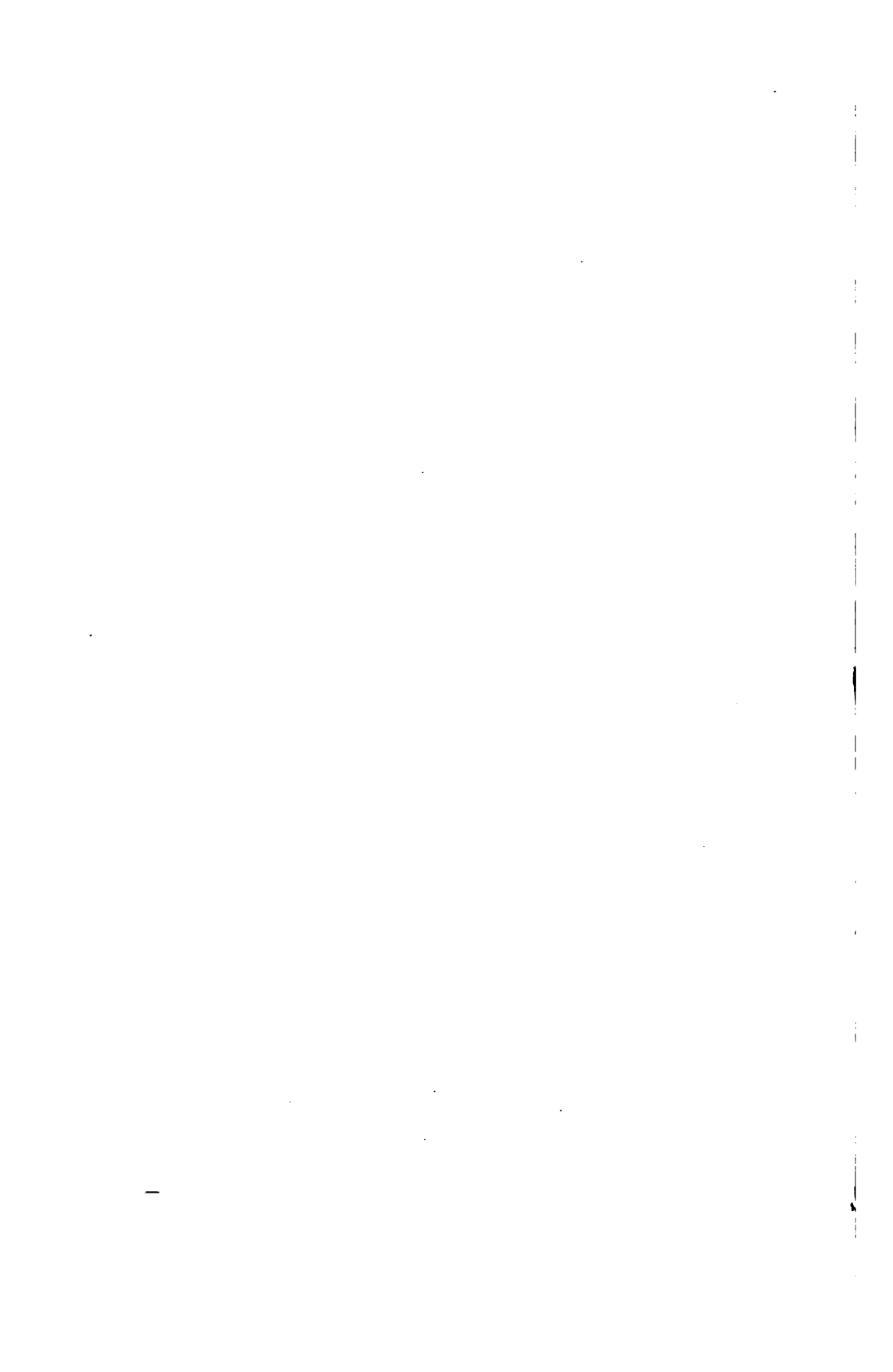
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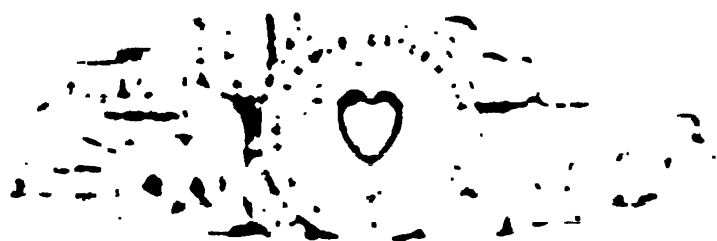
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ANNUAL REPORTS  
OF THE  
COMMITTEE ON WATER,  
TO THE  
WATER COMMISSIONER,  
OF THE  
WATER REGISTRAR,  
OF THE  
CITY OF WORCESTER,  
FOR THE YEAR  
1881.









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ANNUAL REPORTS  
OF THE  
COMMITTEE ON WATER,  
THE  
WATER COMMISSIONER,  
THE  
WATER REGISTRAR,  
AND THE  
ENGINEER IN CHARGE OF CONSTRUCTION OF DAM  
AND RESERVOIR ON TATNUCK BROOK,  
OF THE  
CITY OF WORCESTER,

*Sup.  
In City 1883*

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ASTOR, LENOX AND  
TILDEN FOUNDATIONS  
1902

FOR THE YEAR ENDING NOVEMBER 30, 1883.



WORCESTER:  
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1884.

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# ANNUAL REPORT

OF THE

## COMMITTEE ON WATER.

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*To the Council of the City of Worcester :—*

In conformity with an ordinance of the city, the *Joint Standing Committee on Water* submit their report with those of the *Water Commissioner, Assistant City Engineer and Water Registrar*, for the year ending November 30th, 1883.

For all details we refer to these reports, from which it will be observed that the past year has been a busy one for the department.

### WATER SUPPLY.

The subject of an additional supply of water for our city has occupied much of the attention of Water Committees for several years, and the adjustment of the question in all its phases proved no easy task. The report submitted to the City Council by the Committee of last year being adopted, the initiative step was taken, and in January of the present year orders were prepared for the taking of the water of Tatnuck Brook, and for the purchase of such iron pipe as might be needed, which orders passed the Council February 6th, 1883. The work pertaining to the Reservoirs and Pipe Line involved much time and labor, and was performed, under the supervision of sub-committees, to their satisfaction. The season was remarkably propitious for the enterprise, and the delay in the progress of the work, by reason of

inclement weather, was so slight that no detriment was experienced. No accident of a serious nature occurred, which fact, considering the magnitude and nature of the work, was something unusual.

The work was virtually completed November 27th, 1883, when your Committee realized a relief from responsibilities which were attended with duties of no ordinary nature. They have the satisfaction of knowing that the long contemplated question of an additional supply of water has been settled, and can naturally, with some degree of pride, review their participation in the attainments of results so beneficial to the interests of a large and growing community. They deem it a privilege afforded them in stating that the new source is being practically utilized, which, in a great measure, rewards them for efforts made in achieving such a desired object.

The accomplishment of the work occurred none too early, for without a rain-fall of unusual amount, the present supply of water stored will hardly prove adequate to the expected demands for the next three months.

The cost of the New Supply will of course augment the city debt, but when the constant growth of the city, with the urgent necessity for a further supply is considered, the expense created in securing it will seem a lighter burden to our citizens, and prove a rich legacy to bestow upon coming generations.

Boundary lines have been established for land in Holden taken by the city, and the matter of land damages will subsequently require attention.

The total cost of the work of New Supply to December 1st, 1883, exclusive of land damages, is \$223,574.34.

#### THE DEPARTMENT.

A large amount of work has been performed by the department foreign to that pertaining to the new pipe line to Holden. Numerous petitions for the extension of mains were granted, and a larger number of services were laid than in any previous season for ten years. A large quantity of cement lined street mains

has been taken up or discarded, and new cast iron mains substituted therefor.

The short supply of water necessitated pumping part of the season, which work ceased October 9th, 1883.

We refer to the reports of the Commissioner and Registrar for details of the Account for Construction and Maintenance, which in the aggregate shows that the past year has been one of unusual activity.

#### RESERVOIRS.

Five Reservoirs are now owned by the city, which are in good condition. The land adjacent to Bell Pond was purchased last year, and early this season buildings were removed, and the surroundings placed in better condition than ever before. This basin is a valuable auxiliary to our water system, and the money expended in improving it has been wisely disbursed. Under the direction of the Commissioner, Lynde Brook Reservoir has received much attention, and a great abundance of vegetable matter, stumps, and *débris* has been removed. The channel above the road has been widened and straightened, a substantial stone wall has been extended on the boundary line of the basin, which improvements are in marked contrast to the former state of things in this locality.

The basin of the Holden Reservoir has been cleared and burned over; the channel between the upper and lower reservoirs has been cleaned; and no pains spared in effecting results which would insure a good quality of water, and there is no apparent reason why it should not be excellent.

|                 |   |                                                   |
|-----------------|---|---------------------------------------------------|
| S. E. HILDRETH, | } | <i>Joint<br/>Standing Committee<br/>on Water.</i> |
| CHAS. G. REED,  |   |                                                   |
| JOHN G. BRADY,  |   |                                                   |
| E. O. PARKER,   |   |                                                   |
| BENJ. BOOTH,    |   |                                                   |
| D. J. SAVAGE,   |   |                                                   |
| B. W. CHILDS,   |   |                                                   |

*Worcester, December 17th, 1883.*

# REPORT

OF THE

## WATER COMMISSIONER.

---

### *To the Joint Standing Committee on Water :*

The Commissioner's annual report of the operations of the Department for the year ending November 30, 1883, is respectfully presented.

#### LYNDE BROOK RESERVOIR.

The water in this reservoir has been of uniform quality, but in quantity not equal to the consumption. The deficiency was supplied by pumping at New Worcester from Tatnuck Brook. In Table A is given the record of the daily height of water in this reservoir, also the rainfall.

By referring to this table it will be seen there was a gradual loss from November 30, the date of the last report, to January 12, and a gain from this time to June 12, when 32.83 feet was the highest elevation for the year, or 4.57 feet below the rollway. November 30 of this year there was 24 feet on hand or two hundred and sixty-one million, nine hundred and ninety-nine thousand gallons. The brook above the reservoir has been turned from its former crooked course into a new trench which has been dug as far north as land owned by the city, so that in time of severe storm the water will be confined to one trench and not overflow the valley as formerly. The gate houses and horse shed have been painted, the extension of the wall, and the land around the reservoir have received the usual attention, while many of the stumps have been taken out and some of the mud removed from the bottom.

#### BELL POND.

This reservoir has not been full since it was partially cleaned in 1882, owing to the severe drought and the increased use from here, but it has been filled from Lynde Brook Reservoir. No

complaint has been made of the quality of the water since the reservoir was cleaned, though with low water it is plainly seen that not enough was done. There is evidence of a leak at the north-easterly corner of the reservoir, which is thought to come through a culvert leading from the pond, and should be repaired in warm weather. The buildings have been removed from the land at the westerly end of the pond and the land will be sown with grass in the Spring.

#### HUNT RESERVOIR.

The calls upon the department have been so frequent that nothing has been done here.

The fence should have some repairs and be painted next season and some work done on the embankment to prevent future wash by rains.

#### NEW SUPPLY.

A contract was made, March 7th, with A. H. McNeal of Burlington, N. J., to furnish the twenty, twenty-four and thirty-inch pipe for the new pipe line from the Tatnuck Brook distributing reservoir to Main street for thirty-five and  $\frac{85}{100}$  dollars per ton of 2,240 pounds, delivered in Worcester.

The contract for drawing the pipe from the cars to the line of work was given to H. S. Pike, for sixty-seven cents per ton. These parties presenting the lowest bids in each case.

Work on this line was commenced May 1st and continued without interruption till the line was completed from the distributing reservoir to Main street, October 10th, two days after the last invoice of pipe was received in Worcester. Thirty-inch pipe was laid from the reservoir to the intersection of Chandler and Mill streets; twenty-four-inch in Chandler street from Mill street to Park Avenue; and twenty-inch from Park Avenue to Main street. The four and eight-inch pipe in Chandler street from Abbott to Main street was taken out and all street, hydrant and service connections were made with the new line. Two hydrants were set in Tatnuck, one at the corner of Pleasant street and the other at the corner of Mill street. One at the corner of May street and another at the corner of June street. Most of the

houses along the line are now connected and supplied with water. A pipe has been laid through June street to May street, and a petition is now before you for a pipe in Pleasant street from Chandler street easterly.

The cost of pipe line is as follows :—

|                                |              |
|--------------------------------|--------------|
| For Pipe and special castings, | \$98,271 26  |
| Valves and hydrants,           | 8,191 15     |
| Lead,                          | 3,658 86     |
| Freight and trucking,          | 2,702 08     |
| Powder and fuse,               | 209 27       |
| Labor (men),                   | 27,859 80    |
| Transportation (men),          | 1,878 46     |
| Packing, fuel and cement,      | 244 49       |
| Traveling expenses,            | 143 87       |
| Engineering,                   | 97 22        |
| Repairing sewer,               | 82 45        |
|                                | <hr/>        |
|                                | \$182,887 41 |

Length of new supply pipe line 22,120 feet or 4.19 miles as follows :—

|         |              |
|---------|--------------|
| 20 in., | 4,846 feet.  |
| 24 "    | 10,714 "     |
| 30 "    | 7,060 "      |
|         | <hr/>        |
| Total,  | 22,120 feet. |

#### STREET MAINS.

All the mains ordered by the City Council have been laid except Bloomingdale street, which will be laid as soon as the pipe is received.

Table B shows the streets where mains have been laid this year and the number of feet laid, with the number of gates and hydrants in each street, also the number of feet re-laid. Pipe laid for extension of mains 27,771 feet to replace pipe taken out 10,074 feet, making the total length of pipe laid 37,845 feet.

The building of the new bridge over Cambridge street, on line of the Providence & Worcester R. R. required that 760 feet of the 16-inch high service pipe in Cambridge street be changed to conform to the new grade of the street.

The number of feet of wrought iron cement-lined pipe taken out or abandoned is 11,161.

As considerable apprehension exists in the minds of many of our citizens relative to the merits of wrought iron cement-lined pipe as compared with cast iron, it may be well to mention some of the reasons for the changes made. In Providence street the cement pipe was laid for a light pressure in 1864. In 1872 a connection was made with the high service and this pipe subjected to a pressure of from ninety to one hundred pounds per square inch, and has frequently burst, sometimes doing extensive damage to the highways and also to private property.

East Worcester street was re-laid because of the close proximity of the sewer trench and water pipe, and the sandy soil causing a settling of the pipe, so that a slight change in location was necessary.

Hudson street pipe was burst by lightning during the shower of June 8th, nearly the entire length of the street.

The grade of Piedmont street has been changed since the pipe was laid, so that the pipe was from nine to twelve feet below the surface, making unusual expense for all street, hydrant and service connections that were called for.

A change in the grade of Southbridge and Lafayette streets last year necessitated a change of pipe in this locality.

The pipe in Chandler street was of too small diameter to be used in connection with the new line from Tatnuck Brook.

A careful investigation will no doubt convince all of the wisdom of the Water Committee of 1864 who, after extended investigation, decided upon this kind of pipe, in that time of fluctuation in prices, especially when the difference in price between this and cast iron, revenue from the sale of water, protection from fire, and the many indirect advantages that follow the introduction of water are considered.

The number of hydrants set this year is twenty-eight, located as follows :—

Ætna street, corner Providence street.

Ascension street, corner Bloomingdale street.

Baker street, corner Wayne street.

Cambridge street, opposite Cambridge street place.

Camp street, between Southgate and Cambridge streets.

Chandler street, between King and Queen streets.

Chandler street, corner Bellevue street.

Chandler street, corner June street.  
Chandler street, corner May street.  
Chandler street, corner Mill street.  
Chandler street, corner Pleasant street.  
Colton street, corner Washburn street.  
Douglas street, corner Douglas court.  
Douglas street, corner Cambridge street.  
Endicott street, between Ward and Vernon streets.  
Grand street, corner Douglas street.  
Grand street, corner Grand street court.  
Hacker street, corner Hacker court.  
Hacker street, corner Cambridge street.  
Hanover street, between Kendall and Belmont streets.  
Illinois street, corner Grand street.  
Illinois street, corner Gates street.  
June street, corner May street.  
Mason street, corner Parker street.  
Mitchell street, at west end of street west of Wire Mill.  
Musquago street, corner Albany street.  
Pattison street, corner Batchelder street.  
Prospect street, opposite Normal street.

Gates set during the year, twenty-six.

Table C shows the number of service pipes, with the amount of pipe in feet and miles. Number of service pipes put in, four hundred and fifty-nine. Number feet of service pipe laid, 21,552. Pipe laid for temporary mains, 8,023 feet, the expense being charged to the parties supplied.

Meters set during the year, five hundred and nine; making five thousand one hundred and ninety-seven now in use.

Bills have been rendered to the Treasurer, for labor and materials, \$21,593.85.

The value of stock and tools on hand November 30, as per inventory, is \$40,194.80.

Number of leaks repaired, one hundred and forty-seven. On cement pipe ninety-seven, on cast iron pipe twenty-four, on service pipe twenty-four, on hydrant and stop one each. Thirteen hydrant boxes, seventy-three gate boxes and seventy stop boxes have been replaced. One hundred and eighty-five service pipes have been cleaned out.

Respectfully submitted.

FRANK E. HALL,  
*Water Commissioner.*

WORCESTER, December 20, 1883.

## Showing the Daily Height of V

| Date. | December, '82. |            | January, 1883. |            | February. |            | March. |            | April  |
|-------|----------------|------------|----------------|------------|-----------|------------|--------|------------|--------|
|       | Water.         | Rain fall. | Water.         | Rain fall. | Water.    | Rain fall. | Water. | Rain fall. | Water. |
| 1     | 22.67          | .....      | 19.74          | .....      | 19.11     | .....      | 23.00  | .....      | 25.13  |
| 2     | 22.40          | .02        | 19.64          | .03        | 19.24     | .....      | 22.93  | .....      | 25.15  |
| 3     | 22.35          | .....      | 19.48          | .....      | 19.36     | .....      | 23.16  | .....      | 25.24  |
| 4     | 22.17          | .....      | 19.31          | .....      | 19.36     | 1.10       | 23.24  | .....      | 25.36  |
| 5     | 22.04          | .....      | 19.11          | .....      | 19.50     | .....      | 23.23  | .....      | 25.57  |
| 6     | 21.92          | .30        | 18.93          | .....      | 19.57     | .....      | 23.15  | .....      | 25.88  |
| 7     | 21.70          | .10        | 18.80          | .12        | 19.71     | .82        | 23.09  | .38        | 26.32  |
| 8     | 21.72          | .....      | 18.63          | .....      | 19.80     | .....      | 22.95  | .....      | 26.50  |
| 9     | 21.82          | .....      | 18.46          | .....      | 19.85     | .....      | 22.83  | .....      | 26.65  |
| 10    | 21.85          | .20        | 18.30          | .05        | 19.85     | .....      | 22.70  | .30        | 26.87  |
| 11    | 21.77          | .10        | 18.12          | .....      | 19.93     | .67        | 22.70  | .05        | 27.06  |
| 12    | 21.65          | .....      | 17.93          | .....      | 20.00     | .....      | 22.58  | .....      | 27.25  |
| 13    | 21.53          | .60        | 17.90          | .48        | 20.04     | .....      | 22.45  | .....      | 27.70  |
| 14    | 21.53          | .....      | 17.92          | .....      | 20.06     | .....      | 22.34  | .....      | 28.09  |
| 15    | 21.45          | .....      | 18.08          | .....      | 20.09     | .33        | 22.24  | .....      | 28.28  |
| 16    | 21.35          | .....      | 18.18          | .....      | 20.13     | .....      | 22.51  | .....      | 28.42  |
| 17    | .....          | .....      | 18.12          | .25        | 20.21     | .12        | 22.59  | .....      | 28.55  |
| 18    | .....          | .....      | 18.12          | .....      | 21.63     | .....      | 22.63  | .....      | 28.65  |
| 19    | .....          | .....      | 18.15          | .12        | 22.06     | .....      | 22.93  | .....      | 28.75  |
| 20    | .....          | .....      | 18.20          | .....      | 22.41     | .....      | 23.31  | .58        | 28.82  |
| 21    | .....          | .....      | 18.34          | .65        | 22.60     | .02        | 24.00  | .....      | 28.98  |
| 22    | 20.65          | .....      | 18.56          | .....      | 22.64     | .....      | 24.22  | .....      | 29.09  |
| 23    | 20.65          | .62        | 18.75          | .....      | 22.64     | .....      | 24.34  | .....      | 29.16  |
| 24    | 20.57          | .....      | 18.82          | .....      | 22.60     | .....      | 24.34  | .....      | 29.20  |
| 25    | 20.40          | .....      | 18.86          | .....      | 22.58     | .40        | 24.35  | .....      | 29.36  |
| 26    | 20.57          | .....      | 18.87          | .....      | 22.93     | .....      | 24.37  | .....      | 29.43  |
| 27    | 20.49          | .....      | 18.90          | .35        | 23.03     | .....      | 24.54  | .06        | 29.48  |
| 28    | 20.40          | .....      | 18.94          | .....      | 23.05     | .15        | 24.74  | .....      | 29.54  |
| 29    | 20.24          | .....      | 18.95          | .02        | .....     | .....      | 24.93  | .....      | 29.59  |
| 30    | 20.07          | .....      | 18.90          | .....      | .....     | .....      | 25.02  | .09        | 29.64  |
| 31    | 19.99          | .....      | 18.93          | .17        | .....     | .....      | 25.07  | .....      | .....  |
|       |                | 1.94       |                |            | 2.24      | 3.61       |        |            | 1.46   |

ending  
6 inches.37.40.  
37.90.

The depth of the water is shown in feet and decimals of a foot.

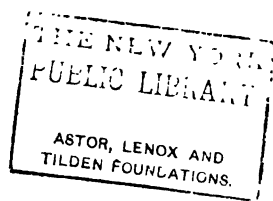


TABLE B.

LENGTH AND SIZE OF PIPE LAID AND NUMBER OF GATES AND HYDRANTS PUT IN DURING THE YEAR.

| STREET.                | LOCATION.                                 | PIPE. |              | No. of<br>Hyd'nts. | No. of<br>Gates. |
|------------------------|-------------------------------------------|-------|--------------|--------------------|------------------|
|                        |                                           | Size. | LGth. in ft. |                    |                  |
| Ætna Street,           | From Providence Street.                   | 6     | 16.          | 1                  | 1                |
| Albany Street,         | " Musquog Street east.                    | 6     | 83.          |                    |                  |
| Ascension Street,      | " Norfolk Street to B. & A. R. R.         | 6     | 14.          | 1                  |                  |
| " "                    |                                           | 4     | 311.         |                    |                  |
| " "                    |                                           | 2     | 150.         |                    |                  |
| Baker Street,          | " Southgate Street to Cambridge Street.   | 6     | 900.         | 1                  | 2                |
| Camp Street,           | " Main Street to Park Avenue.             | 20    | 4346.        | 1                  | 4                |
| Cambridge Street,      | " Park Avenue to Mill Street.             | 24    | 10714.       | 2                  | 4                |
| Chandler Street,       | " Mill Street to Pleasant Street.         | 30    | 800.         | 3                  | 4                |
| " "                    | " Southbridge Street to Washburn Street.  | 6     | 497.         | 1                  | 1                |
| Colton Street,         | " Extension northerly.                    | 6     | 302.         | 1                  | 1                |
| Crescent Street,       | " Grand Street to Cambridge Street.       | 6     | 873.         | 2                  | 1                |
| Douglas Street,        | " Shrewsbury Street to Henry Street.      | 6     | 926.         |                    |                  |
| East Worcester Street, | " Ward Street to Vernon Street.           | 6     | 970.         | 1                  | 2                |
| Endicott Street,       | " Southgate Street to Grand-Street Place. | 6     | 691.         | 2                  | 1                |
| Grand Street,          | " Southgate Street to Cambridge Street.   | 6     | 718.         | 2                  | 2                |
| Hacker Street,         | " Kendall Street to Belmont Street.       | 6     | 628.         | 1                  | 1                |
| Hanover Street,        | " Pleasant Street to Townsend Street.     | 6     | 700.         |                    |                  |
| Hudson Street,         | " Grand Street to Gates Street.           | 6     | 527.         | 2                  | 1                |
| Illinois Street,       | " Chandler Street to May Street.          | 6     | 758.         | 1                  | 1                |
| June Street,           |                                           | 8     | 50.          |                    |                  |
| " "                    | " Southbridge Street.                     | 12    | 159.         |                    |                  |
| Lafayette Street,      | " Parker Street, northerly                | 6     | 284.         | 1                  |                  |
| Mason Street,          | " Pitt Street westerly.                   | 4     | 441.         | 1                  | 1                |
| Mitchell Street,       | " Pleasant Street to Olean Street.        | 30    | 892.         |                    |                  |
| Mower Street,          | " Shrewsbury Street to Albany Street.     | 6     | 408.         | 1                  | 1                |
| Musquog Street,        | " Foster Street to Mechanic Street.       | 4     | 358.         |                    | 2                |
| Norwich Street,        |                                           |       |              |                    |                  |

TABLE B.—CONTINUED.

| STREET.                                                                                                                                                                    | LOCATION.                                             | PIPE. |              | No. of Hyd'nis. | No. of Gates. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------|--------------|-----------------|---------------|
|                                                                                                                                                                            |                                                       | Size. | Lgth. in ft. |                 |               |
| Clean Street,<br>Parker Street,<br>Pattison Street,<br>Piedmont Street,<br>Prospect Street,<br>Providence Street,<br>Southbridge Street,                                   | From Mower Street and through lot to lower reservoir. | 30    | 5368.        |                 |               |
|                                                                                                                                                                            | " Park Avenue to Mason Street.                        | 6     | 622.         | 1               | 2             |
|                                                                                                                                                                            | " Boylston Court to Arlington Street.                 | 6     | 480.         |                 |               |
|                                                                                                                                                                            | " Main Street to Austin Street.                       | 8     | 1932.        |                 |               |
|                                                                                                                                                                            | " Eastern Avenue to Normal Street.                    | 6     | 443.         | 1               | 1             |
|                                                                                                                                                                            | " Union Avenue to Winthrop Street.                    | 6     | 1106.        |                 |               |
| Chandler Street,<br>"<br>East Worcester Street,<br>Hudson Street,<br>Lafayette Street,<br>Hanover Street,<br>Piedmont Street,<br>Providence Street,<br>Southbridge Street, | " Lafayette Street south.                             | 12    | 368.         |                 |               |
|                                                                                                                                                                            | CEMENT-LINED PIPE TAKEN OUT.                          |       |              |                 |               |
|                                                                                                                                                                            | From Main Street to Abbott Street.                    | 4     | 37,845.      | 28              | 29            |
|                                                                                                                                                                            | " Shrewsbury Street to Henry Street.                  | 8     | 2968.        |                 |               |
|                                                                                                                                                                            | " Pleasant Street to Townsend Street.                 | 6     | 1672.        |                 |               |
|                                                                                                                                                                            | " Southbridge Street.                                 | 4     | 926.         |                 |               |
|                                                                                                                                                                            | " Kendall Street.                                     | 10    | 700.         |                 |               |
|                                                                                                                                                                            | " Main Street to Austin Street.                       | 3     | 189.         |                 |               |
|                                                                                                                                                                            | " Harrison Street to Winthrop Street.                 | 6     | 243.         |                 |               |
|                                                                                                                                                                            | " Lafayette south.                                    | 6     | 1982.        |                 |               |
|                                                                                                                                                                            |                                                       | 12    | 2198.        |                 |               |
|                                                                                                                                                                            |                                                       |       | 368.         |                 |               |
|                                                                                                                                                                            |                                                       |       | 11,161.      |                 |               |

TABLE C.

SERVICE PIPE LAID TO NOVEMBER 30, 1883.

|               | LAID FOR CITY. |        | LAID FOR INDIVIDUALS. |        | No.   |
|---------------|----------------|--------|-----------------------|--------|-------|
|               | Feet.          | Miles. | Feet.                 | Miles. |       |
| Prior to 1865 | 3,800          | .719   |                       |        | 129   |
| 1865          | 5,979.88       | 1.132  | 3,588.67              | .672   | 207   |
| 1866          | 8,592.39       | 1.627  | 7,930.95              | 1.502  | 284   |
| 1867          | 11,231.46      | 2.127  | 12,938.01             | 2.45   | 388   |
| 1868          | 13,237.24      | 2.507  | 11,343.59             | 2.148  | 504   |
| 1869          | 17,958.14      | 3.401  | 12,855.87             | 2.435  | 673   |
| 1870          | 11,403.95      | 2.160  | 11,562.01             | 2.19   | 581   |
| 1871          | 10,089.36      | 1.911  | 9,149.6               | 1.733  | 504   |
| 1872          | 7,444.75       | 1.41   | 6,811.                | 1.29   | 357   |
| 1873          | 6,004.91       | 1.137  | 7,241.                | 1.371  | 315   |
| 1874          | 4,773.85       | .904   | 6,009.5               | 1.138  | 231   |
| 1875          | 4,171.25       | .79    | 5,568.75              | 1.055  | 215   |
| 1876          | 2,368.         | .448   | 2,345.17              | .444   | 104   |
| 1877          | 2,976.33       | .564   | 3,679.67              | .697   | 147   |
| 1878          | 3,207.33       | .607   | 3,354.66              | .635   | 151   |
| 1879          | 3,790.08       | .718   | 4,355.33              | .824   | 181   |
| 1880          | 5,237.5        | .992   | 6,132.91              | 1.161  | 229   |
| 1881          | 6,394.33       | 1.211  | 7,872.66              | 1.49   | 331   |
| 1882          | 7,858.         | 1.488  | 11,632.17             | 2.203  | 377   |
| 1883          | 9,237.10       | 1.749  | 12,315.10             | 2.332  | 459   |
|               | 145,755.78     | 27.602 | 146,696.62            | 27.770 | 6,367 |

# TABLE D.

LENGTH AND SIZE OF PIPE LAID AND NUMBER OF GATES AND HYDRANTS PUT IN TO NOVEMBER 30, 1883.

|                | 2 inch.   | 3 inch.  | 4 inch.    | 5 inch. | 6 inch.    | 8 inch.   | 10 inch.  | 12 inch.  | 16 inch. | 18 inch. | 20 inch. | 24 in. | 30 in. | Miles. | Gates. | H'd's |
|----------------|-----------|----------|------------|---------|------------|-----------|-----------|-----------|----------|----------|----------|--------|--------|--------|--------|-------|
| Prior to 1883  | 18,691.65 | 8,238.25 | 135,735.76 | 1,487   | 95,105.78  | 76,615.47 | 12,938.16 | 36,909.75 | 55,148   | 1,980    | 15,186   | 700    |        | 85.80  | 769    | 690   |
| 1883           | 150       |          | 1,110      |         | 11,957     | 1,982     |           | 527       |          |          | 4,346    | 10,714 | 7,060  | 7.17   | 29     | 28    |
| Total,         | 18,841.65 | 8,238.25 | 136,845.76 | 1,487   | 107,061.78 | 78,597.47 | 12,938.16 | 37,436.75 | 55,148   | 1,980    | 19,532   | 11,414 | 7,060  | 92.97  | 798    | 718   |
| Pipe taken up  |           | 243      | 3,668      |         | 5,051      | 1,672     | 159       | 368       |          |          |          |        |        | 2.11   |        |       |
| Total in feet, | 18,841.65 | 7,995.25 | 138,177.76 | 1,487   | 102,010.78 | 76,925.47 | 12,779.16 | 37,068.75 | 55,148   | 1,980    | 19,532   | 11,414 | 7,060  |        |        |       |
| Miles,         | 2.62      | 1.51     | 25.22      | .282    | 19.32      | 14.57     | 2.42      | 7.02      | 10.45    | .375     | 8.69     | 2.16   | 1.84   | 90.86  | 798    | 718   |

# REPORT

OF THE

## WATER REGISTRAR.

---

*To the Joint Standing Committee on Water :*

GENTLEMEN :—The following report is respectfully submitted for the year ending November 30th, 1883 :

Four hundred and sixty (460) applications for water were received during the year, and four hundred and fifty-nine (459) service pipes were laid, including ten (10) applied for but not granted last season. Eleven (11) applications remain to be acted upon next year.

Bills for water have been rendered to the City Treasurer for collection, as follows :

|                             |                 |                          |
|-----------------------------|-----------------|--------------------------|
| For Metered Water . . . . . | 9,792 . . . . . | amounting to \$89,410 25 |
| Annual Rates . . . . .      | 1,985 . . . . . | “ “ 16,014 46            |
| Total,                      | 11,777          | \$105,424 71             |

The amount of revenue received from water rates for the financial year was \$100,635.85.

The amount of uncollected bills in the hands of the City Treasurer, December 1st, 1883, was \$12,199.06.

The amount appropriated from Water Rates to Sinking Funds was \$47,058.41.

The water was shut off from the premises of eight takers on account of non-payment of bills, and in cases of settlement immediately turned on.

During the year the sum of \$5,696.55 has been deducted from the amount charged for water rates and metered water, owing to the adjustment of bills of water takers, votes of the Committee and for other causes. Of this amount the sum of \$1,941.11 is for metered water bills now in litigation.

The quantity of measured water furnished during the twelve months ending September 30th, 1883, inclusive of water used for street watering, waste, and leakage, was as follows :

|                                               |                      |
|-----------------------------------------------|----------------------|
| From October, 1882, to April, 1883, . . . . . | 209,248,589 gallons. |
| April, 1883, to October, 1883, . . . . .      | 227,671,468 "        |
| Total,                                        | 436,915,007          |

#### METERS.

During the year five hundred and nine (509) meters have been placed upon the works, and the total number in use at the present time is five thousand one hundred and ninety-seven (5,197), the sizes and kinds of which are given below :

| KINDS.          | SIZES.        |               |       |        |       |       |       |       |
|-----------------|---------------|---------------|-------|--------|-------|-------|-------|-------|
|                 | $\frac{1}{2}$ | $\frac{3}{4}$ | 1 in. | 1½ in. | 2 in. | 3 in. | 4 in. | 6 in. |
| Union, Piston . | 1,479         | 297           | 61    | 8      | 14    | . . . | 1     | . . . |
| Union, Rotary . | 2,169         | 110           | 40    | 24     | 68    | 18    | 3     | 1     |
| Desper . . . .  | 849           | 34            | 2     | . . .  | . . . | . . . | . . . | . . . |
| Crown . . . .   | 4             | . . .         | . . . | . . .  | 1     | . . . | . . . | . . . |
| Gem . . . . .   | 10            | . . .         | 1     | . . .  | 1     | . . . | 3     | . . . |
| Worthington .   | . . .         | 3             | . . . | . . .  | . . . | . . . | . . . | . . . |

Nearly every application for a service the past season was accompanied by an order for a meter, a fact which certainly intimates that inducements are offered the consumer in the rates for measured water. Water furnished for less than one cent a barrel can be safely classed in the list of cheap luxuries, and so long as the water taker directs his efforts for the prevention of wilful waste or careless use of water the payment of the tax imposed ought to be cheerfully made. The rates now established in this city are lower than those assessed in thirty cities and

towns from which returns are received. I have heretofore advocated the propriety of having a minimum rate, and still maintain the justice of establishing such a standard in our city, in support of which allow me to offer a few reasons. The time devoted in procuring the monthly registration of meters, the transfer of the same to proper books and the rendition and collection of bills to the amount of fifty cents, entails as much expense upon the city as would a tax of fifty dollars. When a minimum sum is charged such as does not exceed the cost of maintaining a cistern or pump for a family, or when a rate is assessed a dwelling having sinks, water closets, bath tubs, etc., is less than expense incurred before city water was introduced, the charge cannot consistently be deemed exorbitant. When the high price of meters prevented a universal demand for them, many water takers dissatisfied with rates by fixture schedule, expressed a willingness to pay ten dollars annually, asserting that benefits received from city water warranted such an assessment. Subsequently, however, attaching a meter and learning that their bills were much less than anticipated, their opinions as to the worth of water faded away, and satisfaction is evidently obtained in ascertaining how small a quantity of water will float them along. Many instances occur where families are stinted in the use of water by avaricious and parsimonious landlords, and false economy often prevents a quantity of water being used which is actually sufficient for sanitary needs. Many more arguments could be advanced in favor of the adoption of a minimum rate which would command attention.

#### WATER SUPPLY.

The absolute necessity for an ample supply of water for our city was never more clearly demonstrated than it has been during the past season. In all sections of the city wells failed to furnish a quantity sufficient for domestic use, and the number of applicants for city water exceeded any for ten years. The value of an abundant supply of water cannot be over-estimated when protection of property from fire, the sanitary benefits which our citizens desire, and the purity of the water obtained is duly

considered. The new additional supply for which you as a Committee have spared no pains in effecting a speedy utilization will prove a priceless treasure to our city. The consummation of an enterprise which has been agitated for so many years reflects great credit upon your management of the undertaking and cannot fail to result in a blessing to the community.

#### REMARKS.

The daily routine of business in the water department embraces details which increase in number annually and are as varied as the changes in a kaleidoscope. To thoroughly satisfy the hundreds of water takers that visit the office with demands which they think reasonable, would require what the officials consider a sacrifice of the interests of their employers. Many persons appear unwilling to grant the same rights to the city which they would not hesitate to allow an individual under similar circumstances.

The fact that a large bill is incurred by reason of waste of water owing to defective fixtures, or caused by careless or wilful tenants, does not warrant a request that the city should suffer a loss. The city furnishes a commodity at a certain price in the same manner as a merchant furnishes his goods.

The pecuniary value of water is being speedily recognized, and the old theory that "water is as free as air" is pleasant to dwell upon, but when a bomb from the columns of General Expense explodes in the camp of the tax payers, the effect produced is the realization of the intrinsic value of a water supply.

Respectfully submitted.

J. STEWART BROWN,

*Water Registrar.*

WORCESTER, December 17, 1883.

REPORT OF THE ENGINEER  
IN CHARGE OF CONSTRUCTION OF  
DAM AND RESERVOIR ON TATNUCK BROOK  
TO THE COMMITTEE ON WATER.

---

*To the Joint Standing Committee on Water :*

GENTLEMEN.—In the absence of the City Engineer, the undersigned would beg leave to submit the following report of work done under his direction in procuring a supply of pure water from Tatnuck Brook.

The work to be done was the repair of a dam for a storage reservoir, the construction of a distributing reservoir and laying of a line of 30, 24 and 20-inch pipe from the distributing reservoir to Main street.

STORAGE RESERVOIR.

The storage reservoir is situated in the south-westerly part of the Town of Holden, and upwards of five miles north-westerly of the City Hall.

The work consisted of repairing and strengthening a dam formerly used by the mill owners on the stream, and built in 1865, the construction of a gate-house, a pipe line through the dam and the building of a new rollway. It having been decided by your sub-committee on building dam, to board the workmen on the premises, work was commenced on the necessary buildings on May 7th. A boarding-house was erected for the accommodation of 100 men, and afterwards enlarged to accommodate 130 beside the employes of the house. A barn for 20 horses, a shed, blacksmith shop and cement shed were also built, and work com-

menced on the dam May 14th. A temporary dam about 50 feet above the old dam, 6.0 feet high and 242 feet long, was made across the pond by dumping from wheelbarrows. A flume about 80 feet long, 4 feet wide and 3 feet high, carried the water from the pond to a 30-inch pipe already laid through the dam. These were completed about June 1st. This dam and flume were built that the foundations of the embankment and spiling wall might be kept free from water. They answered the purpose admirably, and gave no trouble from leaking. The removal of the old slope paving was commenced at once, and proved to be slow and expensive work. There was a thickness at the foot of the slope of from 10 to 15 feet, of stone, mostly embedded in mud, and very slow and difficult to remove. A large portion of the upper part of the paving was used directly in the spiling wall, and the convenience and ease with which the stone were procured made a considerable saving in the expense of the same.

The spiling wall was located at the foot of and partly in the upper slope of the old dam.

A trench was dug for the foundation, most of the distance from 6.5 feet to 7.5 and 8.0 feet below the level of the mud in the bed of the pond. The depth of mud was usually two or three feet, and the excavation below, through clay, and still lower, a mixture of clay and gravel increasing in hardness and compactness as the depth increased. The foundation throughout the whole length was excellent. The masonry was built against the down stream side of the trench, and wherever sheeting was used it was left in place and the top of the plank cut off as low as practicable. The amount of water percolating into the foundation trench was at no time large, and almost wholly from the pond side. One man with a hand pump was able to readily drain the trench at any time. No springs were encountered. At one point the water made its way into the trench quite freely; this was confined in a chimney which was raised as the filling proceeded.

After being allowed some time to develop itself, it was found to only rise to the height of the water in the pond.

Finally on September 4th, the water was pumped out and the

chimney filled with pure liquid cement—125 gallons being used ; it was allowed a few days to harden, when the embankment was filled over it.

The length of the spiling wall is 370 feet, its thickness from 4 feet to 5 feet, and its height from 4.5 feet at the ends, to 18 feet at its crossing of the natural channel of the brook. The greater portion is from 15 to 17 feet high. The top of the wall is 11.5 feet below the crest of the over-fall stone in the rollway, and its up stream face 29 feet from the top line of the upper slope of the embankment as finished. The stone were small-sized field cobbles from the old slope paving, all carefully cleaned and laid by hand in cement mortar composed of two parts of sand and one part best hydraulic cement. The faces of the wall were left rough and uneven. With the exception of a gap for the flume, the wall was finished about August 10th, and the gap closed about September 5th.

The pipe line through the dam was located at the extreme east-erly end. It consists of two lines of 30-inch cast iron pipe, laid 12 inches to 14 inches apart, weighing 400 lbs. to the foot in length, and  $1\frac{1}{2}$  inches in thickness, ending at the upper end in a gate house, and each line controlled by a 30-inch gate. Above the gate house the water flows in an open trench to the pipes. The pipe line runs at right angles to the centre line of the dam from the gate house to the top line of the lower slope, then turns an angle of 50 degrees toward the centre of the dam, and ends near the natural channel of the brook. The open trench is 240 feet in length, from 11 feet to 19 feet in depth, and runs to deep water in the pond. Excavation on the pipe trench was commenced as soon as possible, the ground cleared of a thick growth of wood, and the work progressed as rapidly as circumstances would permit. The bottom width of the trench was from 8 to 9 feet, near the gate house, *more*, and its depth from 10 to 24 feet. The object of locating the pipes at this point, was to have them pass through a ledge cutting ; this ledge was soon encountered, and was found to extend nearly from end to end of both pipe and open trenches.

The total length of trench is 535 feet, of which more than 400 feet was from 4 to 10 feet in depth in rock ; the greatest depth

being at the end of the dam. This rock was very hard to remove, but although hindering the work to some extent, it answered the purpose, and made a most substantial foundation for the pipes, gates and gate house.

A portion of the pipes were laid in the latter part of July, and the remainder, including the gates, was finished August 24th. The westerly line of pipe, 287 feet long, terminates in the gate house—the easterly line, 297 feet long, runs through the up stream wall of the gate house, and is arranged to draw water from the bottom of the pond only ; this pipe will draw within 21 inches of the extreme bottom of the pond.

The upper end of these pipes is 20.1 feet below the crest of the over-fall stone in the rollway, and have a fall of two feet to the outlet.

The lower end of the trench was filled with earth, but 72 feet of the upper portion of the pipes were imbedded in, and surrounded by, masonry.

In the bottom and sides of the cutting great care was taken to clear away all loose and seamy chips and stone, the ledge was carefully cleaned and washed, and all possible care taken to insure a perfect piece of work. The masonry was carried one foot higher than the tops of the pipes. On the line of the top of the lower slope of the dam, there is a main cut-off wall, four feet thick at top, built to within three feet of the top of the dam. At the westerly end, above the ledge, the wall extends 17 feet into the solid bank and dam. Where uncovered, the ledge was smooth and free from cracks or seams. On the easterly side, the wall extends into, and becomes a part of the rollway. Between this main wall and the gate house, there is another cut-off wall extending to the top of the ledge. Below the main cut-off wall, there are two others, similar to the last described. At the outlet of the pipes there is an end wall, extending 3 feet below the bottom, and 2 feet above the top of the pipes.

This wall connects with the one at the lower end of the rollway, and effectually cuts off any back wash of the water flowing from the pipes. For a distance of 20 feet from the outlet of the pipes, there is a cement paving 2 feet thick, and from that point

to the channel of the stream the surface is covered with a loose rip-rap.

The gate house is built of cut stone, backed by rubble masonry, and cemented inside; it is 10.5x8.0 feet inside, with walls 6 feet thick at the bottom, 5.3 at the top and 25.0 feet high from bottom of waste pipe. This is surmounted by a house built of wood, containing the gate hoisting apparatus. On the up stream face there is an opening 3 feet wide, extending down to within 3 feet of the bottom of the pipes. In the sides of this opening are 3x3 and 2x2-inch grooves for the reception of stop plank, and four screens each 5 feet in height; the former of 2½-inch oak plank, and the latter of heavy brass wire woven 3 to an inch, soldered to heavy brass frames. But planks and screens are removable and interchangeable. The stone work was finished October 13th.

There are heavy retaining walls on the upper side of the gate house, extending about 40 feet into the pond. The down stream face of the gate house is nearly on the line of the top of the upper slope of the dam.

The earth between the westerly side of the open trench and the dam, was taken away and used in the embankment. The earth on the easterly side was sloped and covered with rip-rap to protect from washing. The trench was completed on August 29th, and the temporary flume removed at once, although the small amount of water in the stream did not pass through for some days, the pond being drawn lower than the bottom of the pipes. Very little water came into the trench, and it was only necessary to occasionally bail the water out of the excavation. The earth bank at the gate house and end of the dam was of a very hard compact clay.

Immediately on the removal of the temporary flume, excavations for the removal of the old 30-inch pipe, about 166 feet from the rollway, through the dam, were commenced. This necessitated a cut through the main part of the old dam to the very bottom. This work was completed and pipe removed September 13th. A wall built in the same manner as the spiling wall, 4 feet thick, 17.5 feet high, and 26.5 feet long, extending

to within 10 feet of the top of the dam, was built across the gap, four feet above the line of the top of the lower slope of the dam; the embankment was found in good condition, and built of excellent material. Previous to the removal of the flume and old pipe, some filling had been done on the up stream side of the spiling wall. Before the removal of the slope paving, the slope of the old dam was  $1\frac{1}{2}$  horizontal to 1 vertical. It was even less than that after the removal of the stone and loose earth. On both sides of the main spiling wall, and on the slope of the dam, all objectionable material was removed, and the embankment founded on the best of materials throughout. Efforts to obtain satisfactory material on the pond side of the dam proved failures, and the embankment was mainly filled from pits on the lower side of the dam. This filling proved to be of excellent material. The filling was put in in 6 inch layers, sufficient water being used to compact the whole, thoroughly rolled and carefully rammed near the spiling wall, in the gap, where the old pipe was removed, and wherever the roller could not be used to advantage.

The filling was proceeded with more rapidly after September 13th, and finished, as directed by your sub-committee, on November 10th.

The embankment was carried two feet higher than the old dam, and is 29.5 feet high. The slope as finished is 2 horizontal to 1 vertical. The lower slope was left mainly as before, although all roots, briars, and stones, were carefully removed, and some material filled on to bring the embankment to a good line and slope. The lower slope is about  $1\frac{1}{2}$  horizontal to 1 vertical. The old embankment was 12 feet, and the new is about 25 feet wide on top. The season was too far advanced to permit of grassing over any portion of the work, which should be done in the spring. The upper face of the embankment is covered by a layer of large ledge and field stone, two feet or more in thickness, carefully laid, and is a very thorough piece of work. This was finished November 9th. From the gate house the centre line of the dam bears S.  $62^{\circ}$   $10'$  W.

In the early part of the season your committee decided to

locate the rollway in the hillside at the easterly end of the dam. It runs beside of and parallel with the pipe trench. Owing to the press of other portions of the work, excavations were not commenced on the rollway until October 5th. From about the 10th of October the work was carried forward more rapidly, and finished November 27th. The crest, or overfall stone, were set November 8th. The length of the rollway on the centre line is 321.5 feet, and its width 30 feet inside the walls. All the stone-work in the rollway is laid in cement and done in a most thorough manner. The upper end of the paving is on the line of the up-stream side of the gate house; from that point to the overfall stone, 45.5 feet, the paving is 2.25 feet deep. The retaining walls are 9.5 feet high, and 5 feet thick, the top level with top of the embankment, and 5.0 feet above the overfall stone. A portion of that next the gate house is 16 feet high, to gain a good footing in the natural bank. The easterly wall of the gate house forms a part of the westerly wall of the rollway.

The foundation of the overfall stone extends down 7 feet in very hard compact clay. The easterly end abuts against a clean solid ledge, connects with the wall across the pipe trench, extending into the dam on the westerly end, is built 10 feet into the bank on the easterly side of the rollway. The length of this wall is 87.5 feet. The over-fall stone projects six inches above the paving on either side, and is two feet thick, and two and one-half feet in depth. Southerly from the overfall stone for 46 feet the paving is 4.5 feet thick.

The side walls extend one foot below the paving, and are about 11 feet high, and 4.5 to 5 feet thick. The next 50 feet of paving runs to 2.5 feet, and the side walls 3 to 3.5 feet thick, and 6 to 8 feet high. The remainder of the paving is from 2 to 2.5 feet, and the side walls 3 to 3.5 feet thick, and 6 to 8 feet high, and 3 feet above the paving on the sides. The paving, in cross-section is laid on a curve, the centre sagging 2 feet lower than the sides. The grade of the main portion of the paving is seven feet per hundred.

At the lower end, a cut-off wall extends 2 feet below the bottom of the paving, and connects at the westerly end with the

cut-off wall at the outlet of the pipe line. The end of the paving is on a line with the end of the pipes, and in the centre is 4.65 feet above the bottom of the same. The total fall in the rollway is 17.37 feet. A closely laid pavement was laid 23 feet farther, and the side walls extended the same distance, to protect the outlet of the pipes. In excavating for the rollway, all loam and objectionable material was removed, and the walls and paving laid on a hard, firm foundation. Many nests of rocks and large boulders were met and removed, as far as necessary, and were utilized in the building of the masonry. No solid ledge was encountered except as mentioned above. The excavation for the most part was shallow, usually four to six feet, but opposite the dam and gate house, much deeper, the greatest being nearly 23 feet. In the construction of the rollway, the project of raising the dam 11 or 12 feet was kept in view, and all parts that would be affected were built sufficiently heavy and substantial, so that they might be built upon without any reconstruction. The old rollway at the westerly end of the dam was taken out and the space carefully refilled.

The change in direction of the rollway, at the end of the dam, is made by a curve with a radius of 37.8 feet on the centre line.

During most of the season from 65 to 80 men were employed, and from 16 to 24 horses.

In the early part of October, transportation was furnished all laborers who chose to ride, and the force largely increased. The men at the boarding house remained there from choice almost without exception. During a part of October and November, the number of men of all classes employed was 250, and 37 horses. In the construction of the rollway, one steam and two hand derricks were used, and 30 stone masons and 100 men were employed. The length of the dam, including the rollway, is 671 feet.

The net expenditures for the construction of the storage reservoir have been as follows:

|                                   |             |
|-----------------------------------|-------------|
| Embankment, clearing and grading, | \$24,705 22 |
| Rollway,                          | 9,666 00    |
| Spilling wall, &c.,               | 4,020 96    |
| Gate-house,                       | 5,554 86    |

|                                        |             |
|----------------------------------------|-------------|
| Pipes, gates, and masonry around same, | 6,782 78    |
| Pipe and open trench,                  | 5,182 80    |
| Engineering and superintendence,       | 1,188 42    |
| Total cost,                            | \$57,046 04 |

## DISTRIBUTING RESERVOIR.

The Distributing Reservoir is located on land taken from the farm of Charles T. and Sarah E. Foster, and is situated partly in Worcester and partly in Holden.

Work was begun on May 24th; the trees and brush were cleared away, a temporary channel for the stream excavated around the north-easterly side of the location of the basin, and excavation begun on the same about June 1st.

As the work progressed a ledge was developed on the westerly side of the basin, and extended some distance toward the centre. This somewhat curtailed the area and depth, as it was not thought advisable to excavate any large amount of rock. The material excavated was mostly clay, with quite a large amount of stone toward the southerly end of the basin. Very little water was encountered in the excavation, and it was readily disposed of by one hand pump. A spiling wall was built on the south-easterly side across the original channel of the brook, and extending on both sides of the rollway. This wall is 190 feet long, mostly 12 feet in height, and 3.5 feet thick. It is in the centre and extends to within three feet of the top of the embankment. The south-westerly end of the wall is 26 feet south-westerly of the rollway. The rollway is 30 feet in width, side walls of cut stone with rock face, 3.5 feet thick, and the level of the crest of the overfall stone five feet below the top of the embankment. On the lower side of the overfall stone, the pavement is four feet thick to foot of the outer slope of the embankment, terminating in a cut-off wall six feet deep. The foundations of the side walls to the rollway, are seven feet below the overfall stone. All the masonry was carefully laid, and embedded in good firm materials. The basin is pear shaped with the gate house at the small end. The gate house is at the south-westerly end of the basin.

The foundation is embedded in rock to a depth of from two to four feet.

The upper face is built of cut stone, and the remainder of rubble. There is an opening through this upper wall 3 feet in width, and 12 feet from the top down. There are grooves cut in the sides of this opening, of the same size and with the same arrangements for stop plank and screens as at the storage reservoir. The inside, 8x10 feet, is smoothly cemented.

The walls are four feet thick at the bottom, and three feet at the top, and surmounted by a brick building containing the gate hoisting apparatus, which was put in complete here and at the Storage Reservoir on November 23d.

The gate house stands in the embankment, retaining walls being built from the upper face to the foot of the inside slope.

There are also wings or cut-off walls 6.5 feet and 9.5 feet long, running into the bank on either side, and extending from the ledge to three feet below the top of the dam.

The 30-inch supply pipe to the city terminates in this gate chamber. It is laid on a foundation of masonry for about 75 feet below the gate house. The depth of water that can be drawn through this pipe is seven feet.

A 16-inch waste-pipe runs from the channel of the brook below the rollway, through the gate chamber to the basin, which it effectually drains. The bottom and inside slopes of the basin are paved with field cobbles 10 to 12 inches in depth to within 2 feet of the top of the bank. The slopes of the embankment are  $1\frac{1}{2}$  horizontal to 1 vertical, and it is 15 feet in width on top. After the completion of the basin, it was decided by your committee to enlarge and make permanent the temporary channel around the basin. This was done, an acre of land being bought of Oliver K. Cook, to be used as an outlet, and also to have control of the channel from the waste pipe, a sufficient distance. The slope of this channel next the basin is paved. The bottom width is 15 feet. At the head of this channel a bulkhead is built, with side retaining walls and foundations, all laid in cement mortar, and four openings, each 4.5 feet long and 4 feet high. The channel or inlet to the basin has the same arrangement, and by the use of stop plank, the stream can be controlled at will and made to pass down either or both channels. This may be of

great use in time of heavy rains, or if the water is roily from any cause.

Each channel is spanned by a neat wooden bridge. The bulkhead in the inlet channel is 185 feet from the basin. This channel is 20 feet wide at the bulkhead and 30 feet at the basin, with retaining walls on each side from four to five feet high.

The basin was partially paved ready for the reception of water, had there been any, on October 8th. The embankment was fully completed and all grading in connection with the basin finished November 10th. The waste trench and bulkhead were completed December 1st.

The number of men employed has generally been about 40, but during a part of October and November the number was increased to 75 or 80.

The net expenditures for the construction of the Distributing Reservoir have been as follows :—

|                                           |                   |
|-------------------------------------------|-------------------|
| Earth excavation, grading, trench, &c.,   | \$14,561 22       |
| Masonry,                                  | 2,888 42          |
| Pipe and gates, and excavations for same, | 1,954 56          |
| Gate house,                               | 1,777 44          |
| Paving basin, laying of,                  | 748 67            |
| Bulkheads and foot bridges,               | 544 59            |
| Engineering and superintendence,          | 375 74            |
| Total cost,                               | <hr/> \$22,800 64 |

There was at the close of work on the dam and reservoir, tools and materials on hand to the amount of \$2,424.00, most of which have been turned over to the Water Department.

The pipe used was furnished by A. H. McNeal of Burlington, N. J. The gates and gate opening apparatus by the Boston Machine Co., and all were laid under the direction of the Water Commissioner, to whom the undersigned is under obligation for cordial co-operation and assistance. The erection of the buildings, superstructure of the gate houses, flume, bulkheads, foot bridges and all other wood work has been done by J. C. French in a very satisfactory manner. The cut stone were furnished by Webb & Batchelder, and the paving of the Distributing Reservoir was done by U. O. Richardson. The excavations, embank-

ments, masonry, and all other work, has been done by day labor. All materials have been of the best quality, and the work done in the most thorough and substantial manner, and as economically as was consistent with good work.

The season has been remarkably good for the prosecution of the work, the streams and springs being unusually low, and very little time lost on account of bad weather. Plans and profiles of the pipe line have been made, and such lines and grades given during the season as the occasion required.

Accurate measurements of the capacity of the Storage Reservoir have not been made. In former reports it has been estimated at 450,000,000 of gallons.

No calculation of the amount the Distributing Reservoir will hold above the overfall stone in the gate house, has been made, but it is believed to be not far from 2,500,000 gallons.

Stone monuments have been set on the pipe line, from where it leaves the highway to the Distributing Reservoir, also around the latter, and along the line of the stream from the Distributing to the Storage Reservoir.

Surveys are now being made of the land taken around the Storage Reservoir, but are not yet completed.

Practically all the water that has come into the Storage Reservoir, has been allowed to accumulate till on December 7th, there was a depth of 6.3 feet ; since that time the water has been let into the Distributing Reservoir daily, and used through the main supply pipe.

The depth of water now in the reservoir is 6.00 feet. The water was first turned into the Distributing Reservoir October 13th.

Table of elevations on reservoir dams connected with the Worcester Water Works.

STORAGE RESERVOIR, TATNUCK BROOK.

|                          |        |
|--------------------------|--------|
| Rollway,                 | 740.88 |
| Overfall in gate house,  | 728.88 |
| Bottom of 30-inch pipes, | 720.78 |
| Top of dam.              | 745.88 |

DISTRIBUTING RESERVOIR, TATNUCK BROOK.

|                                        |        |
|----------------------------------------|--------|
| Rollway,                               | 658.00 |
| Overfall in gate house,                | 651.00 |
| Bottom of 80-inch supply pipe,         | 649.45 |
| Bottom of 16-inch waste pipe,          | 648.75 |
| Top of dam,                            | 668.00 |
| Rollway, Lynde Brook Reservoir,        | 828.67 |
| Top of dam, Lynde Brook Reservoir,     | 832.67 |
| Bottom of pipe, Lynde Brook Reservoir, | 791.27 |
| Bell Pond, surface of water,           | 666.50 |
| Hunt Reservoir, surface of Water,      | 658.00 |
| Main street, at City Hall,             | 481.00 |

Respectfully submitted.

LUCIAN A. TAYLOR,

*Engineer in charge.*

WORCESTER, December 17, 1883.



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27

# ANNUAL REPORTS

OF THE

## COMMITTEE ON WATER,

THE

## WATER COMMISSIONER,

AND THE

## WATER REGISTRAR,

OF THE

## CITY OF WORCESTER,

FOR THE YEAR ENDING NOVEMBER 30, 1884.



WORCESTER.

PRINTED BY CHARLES HAMILTON,

311 MAIN STREET.

1885.

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1902



BY *Lucian A. Taylor*  
*Water Commissioner*  
ANNUAL REPORTS *Worcester*  
*Mass.*

OF THE  
COMMITTEE ON WATER,

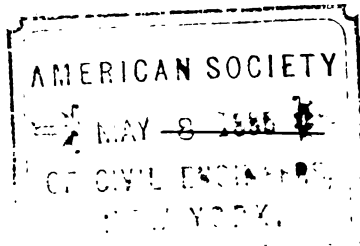
*Compliments of*

*Lucian A. Taylor,*

*Water Commissioner*

OF THE  
CITY OF WORCESTER,

FOR THE YEAR ENDING NOVEMBER 30, 1884.



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1902

# ANNUAL REPORT

## OF THE

### COMMITTEE ON WATER.

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*To the City Council of Worcester :—*

In conformity with the ordinance of the City, the Joint Standing Committee on Water herewith submit their report for the year ending November 30th, 1884, together with the reports of the Water Commissioner, Water Registrar and City Engineer. The record of work performed by this Department for the year just closed justifies the expectation of the Committee, both as to quality and extent ; and a careful perusal of the accompanying reports of the Commissioner and Registrar will, we believe, prove equally satisfactory to the citizens at large. Perhaps the most important feature of the department work is that which relates to the new supply from Holden, while the work proper was completed late in 1883. The entire work of "raking after the cart," as well as testing the practical adaptation of the supply to the need of the City, enters into the record of 1884.

The report of the Commissioner deals minutely with the work done at the Storage and Distributing Reservoirs, and upon the connecting channel as well ; and we are glad to add that the public themselves are perhaps better acquainted with what has been done hereabout than with any other branch of the City work.

After a year of continuous operation we are now prepared to speak of the City's "new supply" as satisfactory in every respect ; and we congratulate our citizens upon the most perfect and adequate supply of pure water possessed by any city in our

land; and what is still more fortunate, it may be increased almost indefinitely as occasion may demand.

The pipe line has also been completed by its extension from the corner of Main and Chandler streets to the intersection of Main with Front street, the total length being 23,676 feet, or substantially four and one-half miles, and over the entire distance not a break or leak has been discovered, a fact which in itself is a sufficient comment upon the quality of the work done upon the line. Commendable progress has been made in the direction of the settlement of damages for land and water-rights. Much more has been accomplished, however, than appears, the nature of the various claims being extremely complicated and difficult of adjustment; but as the settlement is intrusted to a special committee, of which the Committee on Water is but a part, further reference to the subject is not required in this report.

Your Committee are decidedly of the opinion that the "Foster farm," or so much of it as is adjacent to the Distributing Reservoir, should be condemned and the buildings removed, thereby securing complete immunity from pollution to this most important factor in our water system.

The advantages of the new supply cannot be considered alone but are best appreciated when their effect upon the old is better understood. On December 27th, 1883, the water in Lynde Brook Reservoir measured 22.35 feet; from this time forward the depth increased, until on March 23d it measured 38.51 feet, and was allowed to run to waste, the Committee not considering the use of flash boards necessary.

The decrease from this date to November 30th, 1884, was but slight, the water stored being in excess of that of the previous November by 247,096,000 gallons. The quality has been excellent throughout the year, and the fact that almost the entire area of flowage has been covered, ensures even a better quality for the year to come.

The advantage of being able to devote the water of Lynde Brook Reservoir to the demands of the high service has been evident from its increased efficiency on hydraulic elevators and the better average pressure upon the street mains; but even with

this advantage, the fact remains that the pipe line connecting this Reservoir with the City, and its various connections, must receive immediate and heroic treatment, and in this connection we wish it distinctly understood that we do not in the least reflect upon the judgment of those who laid the cement-lined pipes, upon which the trouble now occurs. But it has served its purpose, and in many places it has outlived its usefulness; and its presence is a perpetual menace to the security of property from fire, and water as well. And we recommend the expenditure of a considerable sum each year, to be expended as the knowledge of the Committee shall direct, until the entire forty-nine miles shall have been replaced with iron pipes.

The work of the department upon the various pipe lines and street mains is so fully and accurately described in the accompanying report of the Water Commissioner that we refrain from any detailed reference to it, but recommend its careful consideration to those who would know in detail of the demands made upon the department by our rapidly growing City.

The tables showing the rain-fall of the past ten years, and that relating to the amount and sizes of cement pipe in use, and the length of time it has been laid, are especially interesting and instructive.

A subject upon which much thought has been expended by your Committee crystallized early in the year in a report to the City Council recommending the fixing of a minimum price for metered water. The report met with favorable consideration and the rate was fixed at \$4.00. A result which we are sure will rejoice the heart of ex-Water Registrar Brown, who had for many years suggested its propriety in his Annual Reports.

While your Committee are of the opinion that the rate fixed should have been higher, and so recommended, we are sure that as fixed it imposes no hardships upon the takers, but will rather tend to enhance its value and encourage the use of a sufficient quantity for sanitary purposes.

The necessity of an ordinance regulating the operation of plumbers becomes yearly more apparent, not only from a sanitary but economic point of view, the recent canvass having dis-

closed the fact that not a few takers had tapped the supply pipes *behind* the meters, probably with a view to making water literally "as free as air."

The plumbers themselves have petitioned the Council for relief in the premises ; and we trust the subject will receive the early attention of the coming City Government.

|                |   |                                                   |
|----------------|---|---------------------------------------------------|
| CHAS. G. REED, | } | <i>Joint<br/>Standing Committee<br/>on Water.</i> |
| JOHN G. BRADY, |   |                                                   |
| OTIS WARREN,   |   |                                                   |
| E. O. PARKER,  |   |                                                   |
| B. W. CHILDS,  |   |                                                   |
| JOHN J. WHITE, |   |                                                   |
| A. E. DENNIS,  |   |                                                   |

# REPORT

OF THE

## WATER COMMISSIONER.

---

*To the Joint Standing Committee on Water:*

*Gentlemen:*—The Commissioner would respectfully submit the following report of the operations of the Department for the year ending November 30, 1884.

### LYNDE BROOK RESERVOIR.

On Dec. 1, 1883, the amount of water stored was 260,053,000 gallons. A depth of 23.90 feet or 13.50 below the rollway. There was a decline until Dec. 27, when the amount stored was 232,118,000 gallons and the depth 22.35 feet. This was the lowest point reached during the year. This amount was increased, until on the twenty-third of March the level of the rollway was reached, the amount stored being 681,827,789 gallons. No flashboards were placed on the rollway and the water was allowed to waste, which it did until the first day of June. The highest level reached was on March 27, the depth being 38.51 feet or 730,897,000 gallons. The 24" waste gate was partially open on seven days in March and three days in April. From the above date, March 27, to November 30, the surface has gradually fallen, until on the latter date there was 507,149,000 gallons or 32.95 feet of water stored. This is a gain of 10.60 feet or 275,031,000 gallons from the lowest point and a gain of 247,096,000 gallons from Nov. 30, 1883.

The water has been of excellent quality throughout the year, and as only a small area of the flowage surface has been exposed to the atmosphere, it will in all probability be even better the coming season. Another advantage of a full reservoir has been in the increased average pressure on the street mains and connections on the High Service lines and giving much greater efficiency to hydraulic elevators and motors. Owing to its being

of insufficient depth, the paving in the rollway above the overfall stone had become much broken by the action of the frost, and during the time of highest water some found its way to the outside of the rollway wall, below the overfall stone. While this was in small quantity and seemed to entail no danger to the structure, it was at least undesirable, and as soon as the surface of the water was sufficiently below the level of the rollway to permit, the upper ends of the side walls of the rollway were taken down, the foundations lowered and the walls substantially rebuilt. The paving from the overfall stone to the upper slope of the dam was removed and the material excavated to give a depth of two feet to the paving. At a distance of eleven feet from the overfall stone a cut-off wall four feet deep was built across the rollway into the solid material beneath. The paving between this cut-off and the overfall stone was laid in cement. It is believed these repairs will put this portion of the rollway in much better condition than it has been for some years. Surveys of the land on the west side of the reservoir have been made, the points and bounds located, and a strip of wood and brush cut, much improving this section of the shores. There is also a tract of several acres near the northwest corner of the reservoir from which the brush should be cleared and around which bounds are set, but there seems to be some doubt as to the title, which has not been cleared up. Some progress has been made upon the wall at the northerly side of the reservoir. Everything in connection with the gate-houses and reservoir has been kept in excellent condition, except the house and barn, which are in a dilapidated state, and are hardly in keeping with the prominent position they occupy. It would be a very great improvement if a new house were built farther from the shores of the reservoir and the old one removed or demolished. The top and outer slope of the embankment should receive some slight attention in the spring to put the grass and sod in better condition. Our entire High Service supply has been taken from this reservoir direct, and through the Hunt Reservoir has supplied a part of the Low Service an aggregate of about five months during the year. A table giving the depth of water in the reservoir and the rainfall throughout the year follows.

November 30, 1884.

| October. |            | November. |            | REMARKS.                                                                                                                    |
|----------|------------|-----------|------------|-----------------------------------------------------------------------------------------------------------------------------|
| Water.   | Rain fall. | Water.    | Rain fall. |                                                                                                                             |
| 34.28    | .....      | 33.60     | .18        | Rain fall for year ending<br>Nov. 30, 1884, 38.44 inches.                                                                   |
| 34.25    | .....      | 33.62     | .....      |                                                                                                                             |
| 34.22    | .20        | 33.61     | .....      |                                                                                                                             |
| 34.23    | .18        | 33.60     | .....      |                                                                                                                             |
| 34.24    | .....      | 33.61     | .09        |                                                                                                                             |
| 34.22    | .....      | 33.60     | .....      |                                                                                                                             |
| 34.20    | .....      | 33.59     | .....      |                                                                                                                             |
| 34.18    | .....      | 33.55     | .....      |                                                                                                                             |
| 34.12    | .....      | 33.52     | .....      |                                                                                                                             |
| 34.03    | .....      | 33.49     | .....      |                                                                                                                             |
| 33.97    | .....      | 33.45     | .....      | Height of roll-way, 37.40<br>feet.<br>Top of flash-boards, 37.90<br>feet.                                                   |
| 33.94    | .16        | 33.41     | .....      |                                                                                                                             |
| 33.89    | .....      | 33.36     | .....      |                                                                                                                             |
| 33.87    | .....      | 33.32     | .....      |                                                                                                                             |
| 33.83    | .....      | 33.29     | .....      |                                                                                                                             |
| 33.80    | .....      | 33.25     | .....      |                                                                                                                             |
| 33.77    | .....      | 33.22     | .....      |                                                                                                                             |
| 33.75    | .01        | 33.17     | .....      |                                                                                                                             |
| 33.72    | .....      | 33.12     | .42        |                                                                                                                             |
| 33.70    | .....      | 33.12     | .....      |                                                                                                                             |
| 33.68    | .....      | 32.97     | .....      | The depth of water is shown<br>in feet and decimals of a<br>foot.<br>The rain fall is in inches<br>and decimals of an inch. |
| 33.68    | .42        | 32.93     | .....      |                                                                                                                             |
| 33.66    | .....      | 32.88     | .66        |                                                                                                                             |
| 33.62    | .....      | 32.96     | .....      |                                                                                                                             |
| 33.60    | .....      | 32.96     | .....      |                                                                                                                             |
| 33.58    | .....      | 32.93     | .....      |                                                                                                                             |
| 33.55    | .....      | 32.88     | .....      |                                                                                                                             |
| 33.53    | .18        | 32.85     | .76        |                                                                                                                             |
| 33.51    | .....      | 32.92     | .....      |                                                                                                                             |
| 33.51    | 1.00       | 32.95     | .....      |                                                                                                                             |
| 33.60    | .....      | .....     | .....      |                                                                                                                             |
|          | 2.15       |           | 2.11       |                                                                                                                             |

100,000,000  
PAJOR, TENOX AND  
FUNDATIONS.

## HUNT RESERVOIR.

This has been in use throughout the entire year. When used in connection with the Tatnuck Brook supply from Holden and the supply cut off from the Lynde Brook Reservoir, the level of the surface has been kept within two or three feet of the level maintained when fed direct from Lynde Brook, thus showing very little loss of head. Early in the season a strip of land on the east side of the embankment, thirty feet in width, and connected with Parsons' lane by a driveway twenty feet wide, has been enclosed by a picket fence and an entrance on Parsons' lane built in a substantial manner and with the fence thoroughly painted. This land was purchased in 1869, but had never been fenced or utilized. The top of the embankment and the outer slope have been cleared of brush, briars and roots, and considerable material graded upon the outer slope of the embankment, which has also been re-seeded. The slope paving and coping were repaired in several places and the general appearance of the grounds considerably improved. The 12" gate on the main line from Lynde Brook Reservoir has become very much worn, having been in constant use for sixteen years with the pressure almost entirely from one direction. A new gate of a special pattern has been procured and will be put in place as soon as it can conveniently be done, and at the same time a new floor will be laid in the gate-house.

## STORAGE RESERVOIR, HOLDEN.

This reservoir has been what it was designed to be, the mainstay of our low service supply, and has been used throughout the entire year, with the exception of six days in July. On Nov. 30, 1888, there was 6.00 feet, or 46,102,000 gallons of water stored, Jan. 8, following the amount was 49,739,000 gallons, or a depth of 6.25 feet. From this time the rise was quite rapid, and on Feb. 14 the reservoir was full and running over, the depth being 20.10 feet. There was a surplus from this time until May 1. As this is the first season's use of the reservoir by the Department it is somewhat interesting to note the rapid filling of the

reservoir, which will be seen by an inspection of the accompanying table giving the height of water in the reservoir for the year. On the night of the 26th of March, the greatest observed flow took place, there being a depth of eighteen inches flowing over the over-fall stone in the rollway, a width of thirty feet, and one of the 30" pipes discharging nearly its full capacity. During the season the reservoir was drawn down quite rapidly, the lowest point being reached on Nov. 20, there being on that date 6.10 feet, or 47,546,000 gallons. Nov. 30, 1884, depth of water, 6.83 feet, or 58,477,000 gallons. The water shed of this basin is very quick, the slope of the sides being steep and the crest very regular, generally about one and one-fourth miles from the reservoir, and the farthest point in the basin being only one and one-half miles from the same. It is quite evident from the experience of the past season that this reservoir will not furnish the full low service supply with its present storage capacity. It is also evident that it can be drawn to a very low point without detriment to the quality of the supply, and without any effect upon the pressure in our street mains. Everything, so far as the strength of the dam and rollway were concerned, was finished last year, but a large amount of work has been done in grading and seeding the lower slope and top of the embankment and the grounds near the foot of the slope. The grounds between the dam and the road have been cleared and grubbed. The rollway has been dressed over its entire length, the wall pointed and all little imperfections in the bed remedied. The lower end of the rollway, 23 feet long, was built with paving laid dry; this was considerably displaced by the freshets of last spring, and has been replaced and laid in cement. A good, substantial, double-faced wall has been built along the road side opposite the embankment for a distance of 645 feet. A shed, with office and tool-room attached, has been built, and all the buildings in use during the construction of the dam torn down. No work has been done on the shores of the reservoir towards clearing the wood, and very little trouble has been experienced from leaves or drift wood. By the purchase of the Wadsworth and Chamberlain farms, land has been secured controlling three of the four brooks entering the reservoir for a considerable dis-

tance from the highest point which will ever be flowed. By exercising a proper supervision, I can see no objection to these farms being used for agricultural purposes for years to come. Both farms can no doubt be rented to the present occupants for a fair rental. The channel below the reservoir has been much improved by straightening and deepening as far as the Coes' privilege. When the Coes' and Seagrave's dams are taken down, and the channel cleared to the Distributing Reservoir, it will be a very great improvement, and will facilitate the proper gauging of the supply to the Distributing Reservoir. It is hoped this may be accomplished early in the coming year. The water from this source has been good. A portion of the season it has been slightly discolored, but I think this will disappear with continued use of the reservoir and the improvements mentioned above consummated. A rain-gauge has been in use here a portion of the year, but its accuracy has not been thoroughly tested. A float-gauge, similar to the one at Lynde Brook Reservoir, for showing the depth of water has been placed in the gate house, also apparatus for hoisting and lowering the stop plank and heavy screens in use here. These are working very successfully.

## REPORT OF WATER COMMISSIONER.

TABLE SHOWING THE DEPTH OF WATER IN THE STORAGE RESERVOIR AT HOLDEN, FOR THE YEAR.

| DEC. '83.       | JAN. '84.       | FEB.            | MARCH.          | APRIL.          | MAY.            | JUNE.           | JULY.           | AUGUST.         | SEPT.           | OCT.            | NOV.            | REMARKS.                                                    |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------------------------------------------------------|
| Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. | Depth of Water. |                                                             |
| 1 6.00          | 5.95            | 18.00           | 20.85           | 20.22           | 20.32           | 20.07           | 18.26           | 16.44           | 15.70           | 12.91           | 8.70            | Height of Roll-way. 20.10 feet.                             |
| 2 . . .         | 5.97            | 18.40           | 20.37           | 20.20           | 20.20           | 20.05           | 18.26           | 16.39           | 15.61           | 12.75           | 8.53            |                                                             |
| 3 . . .         | 6.25            | 18.65           | 20.87           | 20.28           | 20.12           | 20.04           | 18.17           | 16.33           | 15.58           | 12.66           | 8.37            |                                                             |
| 4 . . .         | . . .           | 18.85           | 20.84           | 20.01           | 20.11           | 19.93           | 18.07           | 16.80           | 15.89           | 12.48           | 8.22            |                                                             |
| 5 . . .         | . . .           | 14.00           | 20.30           | 19.77           | 20.14           | 19.92           | 18.00           | 16.24           | 15.37           | 12.37           | 7.99            |                                                             |
| 6 . . .         | . . .           | 14.45           | 20.31           | 20.02           | 20.14           | 19.85           | . . .           | 16.36           | 15.37           | 12.26           | 7.73            |                                                             |
| 7 6.30          | . . .           | 16.80           | 20.37           | 20.34           | 20.17           | 19.79           | . . .           | 16.25           | 15.29           | 12.18           | 7.60            |                                                             |
| 8 . . .         | 6.25            | 17.35           | 20.27           | 20.37           | 20.18           | 19.76           | 17.87           | 16.47           | 15.32           | 12.05           | 7.40            |                                                             |
| 9 . . .         | 7.25            | 17.88           | 20.87           | 20.47           | 20.19           | 19.62           | 17.83           | 16.53           | 15.28           | 11.93           | 7.37            |                                                             |
| 10 . . .        | 8.46            | 18.40           | 20.82           | 20.48           | 20.23           | 19.52           | 17.71           | 16.47           | 15.11           | 11.77           | 7.23            |                                                             |
| 11 . . .        | 9.15            | 18.65           | 20.31           | 20.55           | 20.16           | 19.10           | 17.64           | 16.36           | 15.05           | 11.57           | 6.98            | The depth of water is shown in feet and decimals of a foot. |
| 12 . . .        | 9.46            | 18.90           | 20.84           | 20.67           | 20.20           | 19.02           | 17.52           | 16.40           | 14.96           | 11.01           | 6.85            |                                                             |
| 13 6.00         | 9.90            | 19.20           | 20.42           | 20.60           | 20.12           | 18.92           | 17.43           | 16.41           | 14.84           | 10.90           | 6.75            |                                                             |
| 14 . . .        | 10.15           | 20.10           | 19.85           | 20.60           | 20.19           | 18.72           | 17.44           | 16.24           | 14.76           | 10.76           | 6.60            |                                                             |
| 15 . . .        | 10.85           | 20.60           | 18.57           | 20.57           | 20.18           | 18.63           | 17.80           | 16.29           | 14.68           | 10.56           | 6.48            |                                                             |
| 16 . . .        | 10.45           | 20.49           | 18.42           | 20.75           | 20.20           | 18.53           | 17.35           | 16.23           | 14.63           | 10.45           | 6.42            |                                                             |
| 17 5.98         | 10.50           | 20.46           | 18.61           | 20.57           | 20.19           | 18.33           | 17.17           | 16.17           | 14.56           | 10.30           | 6.37            |                                                             |
| 18 . . .        | 10.60           | 20.66           | 18.77           | 20.51           | 20.19           | 18.26           | 17.04           | 16.11           | 14.40           | 10.17           | 6.23            |                                                             |
| 19 5.95         | 10.70           | 20.66           | 18.98           | 20.52           | 20.13           | 18.34           | 16.86           | 16.03           | 14.30           | 10.03           | 6.19            |                                                             |
| 20 . . .        | 10.80           | 20.56           | 19.18           | 20.43           | 20.13           | 18.23           | 16.78           | 15.95           | 14.00           | 9.86            | 6.15            |                                                             |
| 21 . . .        | 10.90           | 20.65           | 19.66           | 20.42           | 20.33           | 18.14           | 16.70           | 15.93           | 13.91           | 9.70            | 6.13            |                                                             |
| 22 . . .        | 10.90           | 20.55           | 19.99           | 20.49           | 20.28           | 17.92           | 16.64           | 15.84           | 13.80           | 9.65            | 6.17            |                                                             |
| 23 . . .        | 11.00           | 20.51           | 20.49           | 20.35           | 20.24           | 17.90           | 16.70           | 15.85           | 13.83           | 9.69            | 6.24            |                                                             |
| 24 . . .        | 11.00           | 20.76           | 20.87           | 20.32           | 20.19           | 17.87           | 16.70           | 15.78           | 13.75           | 9.59            | 6.48            |                                                             |
| 25 . . .        | 11.65           | 20.48           | 20.37           | 20.34           | 20.13           | 17.87           | 16.73           | 15.70           | 13.57           | 9.47            | 6.48            |                                                             |
| 26 5.92         | 11.65           | 20.87           | 20.65           | 20.30           | 20.13           | 18.80           | 16.73           | 15.63           | 13.49           | 9.37            | 6.53            |                                                             |
| 27 5.95         | 12.00           | 20.87           | 21.11           | 20.35           | 20.07           | 19.03           | 16.75           | 15.60           | 13.43           | 9.36            | 6.54            |                                                             |
| 28 . . .        | 12.10           | 20.40           | 20.60           | 20.30           | 20.08           | 18.66           | 16.79           | 15.51           | 13.36           | 9.07            | 6.59            |                                                             |
| 29 . . .        | 12.15           | 20.33           | 20.37           | 20.31           | 20.13           | 18.51           | 16.56           | 15.45           | 13.16           | 9.13            | 6.74            |                                                             |
| 30 . . .        | 12.80           | . . .           | 20.80           | 20.33           | 20.11           | 18.36           | 16.58           | 15.53           | 13.03           | 9.10            | 6.83            |                                                             |
| 31 5.95         | 12.45           | . . .           | 20.25           | . . .           | 20.07           | . . .           | 16.56           | 15.63           | . . .           | 8.89            | . . .           |                                                             |

## DISTRIBUTING RESERVOIR, HOLDEN.

This reservoir has been in constant use throughout the year, with the exception of a few days, and it has been a very valuable addition to the works. It was found when the water was shut off at the reservoir above that this basin became empty in a few days, the main from Hunt Reservoir to New Worcester not being of sufficient capacity to overcome the loss of head except a short time in the night. The embankment and slopes have been seeded and put in good condition. No fencing has been done around the reservoir or along the pipe line to the road. The channel around the basin has been of great service in diverting the water from the basin during severe storms, and ensures a perfect control of the stream at all times. If a portion of the Foster farm with the buildings could be secured it would be a very desirable acquisition, securing this reservoir from possible pollution, and would be the best place to locate a permanent employé in charge of the reservoirs. This basin, as well as the Holden Reservoir, is being very much frequented, and some one should be at hand to protect the interests of the city, and the better to control the flow of water to the basin. Apparatus for hoisting and changing the screens has been placed in the gate-house.

## BELL POND

Has been in constant use for supplying the Worcester Lunatic Hospital, a number of times in cases of breaks in either the high or the low service, and in many cases to supply a portion of the high service line in case of shut-offs for street or other connections. Three or four times during the year the reservoir has been drawn down and refilled from the high service main, the water-shed not being sufficient to keep up the supply. The plank spiling dam at the northeast corner of the reservoir has been removed, as it was found that the water in the enclosed small basin in front of the gate-house became stagnant and impure. Since then the water has been very much improved. The land recently purchased at the northwest corner of the reservoir on Belmont street has been graded and enclosed by a fence. This

reservoir is of very great importance to our system of water supply. Being in such close proximity to the city, it is becoming each year more difficult to keep free from pollution without constant supervision.

#### PIPE LINES.

The 12" cement lined pipe from Lynde Brook to Hunt Reservoir is showing increasing signs of weakness ; several leaks have appeared, but none of a serious character. It is quite likely, however, this line will do service for a good number of years to come. Several leaks have occurred on the 16" cement lined main from Hunt Reservoir to Chandler street, through Leicester and Main streets, two of these being very serious breaks and one doing a large amount of damage. A portion of this line is in very bad condition and so situated that a break must do a great deal of damage, and I would recommend the laying of a 16" cast iron main from Chandler to Jackson or Lagrange streets. This is the section likely to do the most damage in case of breaks, and is subjected to the greatest pressure. A 16" gate has been placed on this line at Beaver street and obviates the necessity of shutting off so long a line as previously in making repairs or street connections, there having been no gate from Hammond street to Webster square, a distance of one mile.

The 16" cement lined main from Bell Pond through Elliott and Thomas streets to Main has given no trouble and is apparently in good condition.

The New Supply main from Holden through Chandler street has been completed by laying a 20" pipe in Main street from Chandler to Front street, where it connects with the 16" pipe in Main and the 12" in Front, and giving a first-class cast iron main through these streets to Lincoln and Washington squares.

This change was made through a portion of the business part of Main street. The old 16" pipe was in very bad condition and in case of a break would, from its location, have almost certainly done much damage, and the successful completion of this line relieves the Department of one source of anxiety. The water takers along the line were supplied through temporary connec-

tions and with very little inconvenience to them or interruption to their supply. All the side street connections were taken up past the line of Main street. The old hydrants, with their connections taken out and new ones with larger connections and capable of delivering double the quantity of water substituted, thus insuring much better fire protection than formerly.

A gate was set on the 16" cement pipe at Chandler street, and none too soon, as a serious break occurred soon after near Hermon street, and but for this gate would have necessitated the shutting off of both the Leicester and Holden supplies. One 20" gate was set at Chandler and one at Front street, thus putting the whole line under perfect control. Each of these are provided with by-pass gates, as are all the main gates on this line. A 12" main was laid in Madison from Main to Southbridge street, completing the New Supply main. The cost of the work on Main street was \$8,954.26 and on Madison street \$1,445.74. The entire line from the Distributing Reservoir in Holden to the City Hall is in the best of condition. No leaks or other defects have ever appeared since it was laid except a small leak at a gate on Main street, and your Committee may feel assured that they have one main line, and that the most important, that is as good as the best in material and workmanship and in grade and alignment. The total length of the main line to Front street is 23,676 feet, or four and a half miles very nearly.

On the High Service line from the Lynde Brook Reservoir there have been quite a number of leaks, three of them being serious breaks. One occurred Feb. 19 on the 20" main, a short distance beyond New Worcester, where a pipe was split its entire length. April 11, on Normal street, the 16" main was badly broken by a blast in grading around the Normal School. At this place there are several hundred feet of pipe not in the location of the streets, these having been changed since the pipe was laid. By the grading of Normal street a portion of this pipe is exposed. This should be relaid in a proper position, and will be quite expensive, as there is considerable ledge to excavate. The alignment would be much improved, as there are now three abrupt turns; one of these would be taken out and the other two

would be easy curves. October 30 a break occurred on Ward street, the 16" main being split open. Fortunately none of these breaks did any damage to private property. The other leaks reported were on lead joints and of no great importance. Several of the gates on this line have been used so much, and the strain on them has been so severe, it will be necessary soon to replace them with new gates or relieve them with by-pass pipes and gates. With the water on one side, the pressure on the face of a 16" gate is fifteen and a half and on a 20" gate nearly twenty-four and a half tons. It requires five or six men to close one of them. The pressure valves between the high and low service at corner of Cambridge and Southbridge streets and at Elliott street are shut off and have not been in use during the year.

#### STREET MAINS.

All the orders passed by the City Council for the laying of street mains have been executed except Lincoln street and Sutton lane. The former was an order to replace the 6" cement pipe by an 8" cast iron from Lincoln Square to Forest Avenue. The season proved so busy, and as no trouble was experienced from breaks, it was thought best to defer the execution of the order till another year. (Sutton lane has been laid since Dec. 1.) The laying of the 12" main in Front street from near Trumbull to Hibernia streets and the abandoning of the same size cement pipe was, perhaps, the most difficult of execution of any work done during the year, owing to the many obstructions encountered and the treacherous nature of the soil. The proximity of the sewer trench and gas main, the crossing of catch basin, drain, gas and elevator pipes occasioned the laying of the pipe an unusual depth much of the distance. The business and traffic of the street was incommoded very little. The old pipe was under the Worcester Street Railroad in the centre of the street, the track having been moved when the street was widened. The old pipe was not taken up, but openings made through for the extension of service pipes. All street connections were relaid past the lines of the street and new hydrants of double the capacity put in place of the old flush hydrants. The change on Prov-

idence street was occasioned by the great number of breaks occurring on that line and the resulting damages. The change in Bloomingdale road east of Grafton street was owing to the small size of the old pipe, the Worcester Steel Works alone requiring at times more water than it would furnish.

This insufficient supply caused the attaching of the section east of the Steel Works and north of Grafton street to the High Service, bringing a pressure of 110 to 140 pounds on the cement lined pipe and causing many breaks. Since the change was made this district has again been attached to the low service, and there have been no complaints of short supply and no leaks have occurred. About half of the pipe removed was cast iron laid from the Bell Pond Aqueduct in 1858. This has been cleaned and nearly all used on repairs and on some street and hydrant connections. The 6" cement pipe on Eastern Avenue from Farwell to Belmont street has been abandoned, and the street, hydrant and service pipes connected to the 12" high service main. This was under high service pressure, and it was thought best not to maintain two lines of pipes at that elevation and continue the risk of breaks occurring on the line. The most important extension of street mains has been the laying of an 8" pipe to Bloomingdale and Lake View. The supply was taken from Shrewsbury street, and laid in Putnam lane, Bloomingdale road, through land of F. A. Harrington, B. & A. R. R. location and land of H. H. Bigelow to Lake View. Releases and rights of way were given by the above parties for the laying and maintenance of the pipe. In Lake View the pipes were laid in portions of Locust, Coburn and Alvarado Avenues and Anna street; 8,712 feet of 8" and 1,610 feet of 6" pipe were laid, and ten gates and sixteen hydrants set. The annual appropriation being insufficient, the expense was met by a special appropriation of \$17,500.00. As was expected, considerable rock was encountered. The work was completed, however, for \$15,886.67, leaving an unexpended balance of \$1,613.33. This line will no doubt contribute very largely to the development of this section of the city, but it will probably be a long time before the regular water rates will pay the guaranteed interest on the cost. It may not

be amiss in this connection to state that while the guarantee of six per cent. may seem to some petitioners a high rate, it must be borne in mind that the Department must maintain and keep the works in order, is to considerable additional expense for service pipes, and as the water rates are applied towards the payment of the interest on the cost, the Department practically receives no revenue from the water supplied. Taking these facts into consideration, certainly the rate cannot be called excessive.

Considerable extensions of street mains have been made during the year. There are several petitions before you now; some of them will undoubtedly be answered early the coming season. For better supply and fire protection there should be an 8" pipe laid from Providence to Houghton street in Union Avenue. There are in this section more than two miles of streets supplied through a four-inch cement pipe in Harrison street, which is under heavy pressure from the High Service and very liable to breaks. This line would connect with quite a number of cross streets that are now dead ends, and would ensure a good circulation and much better fire protection. I would recommend the laying of this pipe the coming year.

There should be a 12" main in Cambridge street from Chelsea to Crystal, and eventually as the street is graded and built upon, through Crystal to Main street. The takers on Cambridge street are attached to the High Service main. The pressure is so great, this practice should be discontinued, and those now connected should be attached to the low service as soon as the pipe is laid. All the cross street mains are now dead ends and this would bring them into circulation. When completed, this will be a very important feeder, supplying the whole South Worcester District, and eventually would be extended to Millbury street. I recommend that a commencement be made on this line the coming year by laying a pipe from Chelsea to Camp street. Of the cement lined pipe needing attention, perhaps the most important after Main street, already mentioned, is Union and Church streets from Central to Front. This is a 10" pipe and is in very bad condition. Three serious breaks have occurred during the past year, two doing considerable damage to private

property, the third breaking in the sewer and running for a number of hours before it could be located. It is a very important feeder, supplying and giving fire protection to some of the largest and most important shops and manufactories in the city, and in case of a break liable to throw hundreds of men out of employment during repairs. A gate has been set at Foster street on Union, to shorten the line shut-off in case of repairs or connections. I should earnestly recommend the laying of a 12" pipe in these streets the coming year.

A portion of the pipe in Austin street is in very bad condition and gives much trouble by the flooding of cellars and damage to private property. A new pipe from Main to Oxford street is much needed. These are some of the most pressing wants of the Department for the securing of a surer and more efficient supply in the several streets and districts named. The East Worcester District, Bloomingdale and Lake View are supplied by the 8" cement pipe in Shrewsbury street from Washington Square to Cross street. It is too small for the district supplied, and is in very bad condition, a number of breaks having occurred during the past year, shutting off the entire district during repairs. I should recommend a 12" pipe be laid when this change is made.

#### HYDRANTS.

There have been sixty-three new hydrants set during the year. Twenty of these were changes and three are private. Sixteen flush and five box post hydrants have been taken out. The number added to the works has been forty-three.

The total number connected with the works is now 761. All the new ones used are of the Chapman pattern and are giving good satisfaction. Two post hydrants have been broken by teams running against them. There have been thirty-four hydrant boxes renewed during the year. A new list giving kind and location of hydrants is being prepared. The care and maintenance of the hydrant service is a work of much importance and considerable expense, for which the Department receives no credit financially. Our service is excellent, the pressure being much

better than formerly and all are in perfect working order so far as known. One was found recently with the valve screw broken by some one that had no authority to use, and certainly no skill in the manipulation of hydrants. This is the only one that has been found that would have been useless in case of fire.

Location of new and changed hydrants are given in the following table:

Alvarado Avenue, east side, opposite J. Lee's house.  
Alvarado Avenue, east side, opposite J. J. Coburn's house.  
Alvarado Avenue, east side, opposite Mrs. Tourtellotte's house.  
Anna street, north side, northwest corner Alvarado Avenue.  
Anna street, north side, northwest corner Coburn Avenue.  
Bloomingdale road, north side, northeast corner Putnam court.  
Bloomingdale road, north side, northeast corner Hillside Avenue.  
Bloomingdale road, south side, junction Plantation street.  
Bloomingdale road, north side, opposite Harrington court.  
Bloomingdale road, north side, opposite J. Howes'.  
Bradley street, north side, northwest corner Washington street.  
Bradley street, north side, northwest corner Gold street court.  
Burncoat street, west side, opposite C. J. Green's.  
Camp street, west side, northwest corner Crompton street.  
Camp street, west side, near Cemetery fence.  
Canterbury street, west side, opposite School-house.  
Canterbury street, west side, opposite Patrick Rogers'.  
Clifton street, west side, opposite Number 4.  
Coburn Avenue, east side, opposite E. Holmes'.  
Coburn Avenue, east side, opposite Engelbrekstrom's.  
Crompton street, north side, northeast corner Woodward street.  
Foster street, south side, southwest corner Hibernia street.  
Front street, in front of No. 240.  
Front street, northwest corner Bridge street.  
Front street, in front of No. 180.  
Front street, in front of No. 150.  
Front street, in front of No. 124.  
Locust Avenue, east side, front of J. C. Coburn's.  
Locust Avenue, east side, northeast corner Anna street.  
Madison street, north side, opposite Beacon street.  
Main street, northwest corner Old South Church.  
Main street, northeast corner Park street.  
Main street, in front of No. 519.  
Main street, northeast corner Allen court.  
Main street, northeast corner Burnside court.  
Main street, northeast corner Myrtle street.  
Millbrook street, north side, opposite Wilder's.  
Orchard street, west side, southwest corner Bismark street.

Plantation street, west side, front of J. W. Wetherell's.  
Plantation street, west side, front of J. A. Bancroft's.  
Plantation street, west side, northwest corner Fairview avenue.  
Pleasant street (Tatnuck), north side, front of Old Tavern.  
Pleasant street (Tatnuck), north side, opposite Kendall's.  
Providence street, in front of No. 4.  
Providence street, southeast corner Swedish Church.  
Providence street, northwest corner Ledge street.  
Providence street, northwest corner Harrison street.  
Putnam court, southeast side, at angle south side B. & A. R. R.  
Ripley street, north side, northwest corner Beacon street.  
Richland street, south side, front of No. 32.  
Union Avenue, north side, between Ward and Vernon streets.  
Vernon street, west side, opposite G. L. Robbins'.  
Vernon street, west side, opposite W. F. Pond's driveway.  
Vernon street, west side, opposite No. 111.  
Vernon street, west side, south side J. S. Perry's south driveway.  
Woodland street, east side, 300 feet north of May street.

#### PRIVATE HYDRANTS.

Pakachoag Mill. In yard.  
Rawson's Factory, Northville. In yard.  
Worcester Steel Co. In yard.

#### GATES.

There have been 59 new gates set ranging in size from 4" to 20". A new list of gates connected with the works, and the locations, carefully corrected, will be made as soon as possible. The total number of main gates on pipe lines and street mains is 850. There have been 71 boxes renewed, mostly by cast iron.

A table is given showing the number of feet of each size of pipe laid. The hydrants and gates set, and the feet of pipe taken up or abandoned. Also a table giving the total length of each size of pipe, the gates and hydrants set each year.

It will be seen that the past season has been a busy one in the laying of street mains, more miles of pipe have been laid than any year since 1873, except 1883, when the new pipe line from Tatnuck Brook was laid. The pipe, 822 tons, and special castings, 44 tons, have been from the Warren Foundry and Machine Co., and have been of good quality and obtained at a very reasonable price. Also 43 tons of castings for gate and stop boxes, sleeves, plugs, &c., have been obtained

of Heald & Britton of this city. Considerable pains has been taken to obtain a correct list of the cement pipe at the commencement of the year. The result is shown in the following table :

CEMENT LINED MAIN PIPE IN USE, NOVEMBER 30, 1884.

|                   | 2"     | 3"    | 4"     | 6"     | 8"     | 10"   | 12"    | 16"    | 18"   | 20"   | Total.  |
|-------------------|--------|-------|--------|--------|--------|-------|--------|--------|-------|-------|---------|
| 1864              |        |       | 1,424  | 4,412  | 53     |       | 5,885  | 14,549 | 1,980 | 1,056 | 28,809  |
| 1865              | 144    |       | 8,444  | 4,761  | 6,023  | 1,650 |        | 2,300  |       |       | 23,322  |
| 1866              | 1,107  |       | 9,744  | 2,073  | 9,387  |       |        | 1,869  |       |       | 24,180  |
| 1867              | 2,889  | 4,444 | 5,000  | 2,819  | 8,280  |       | 1,000  | 848    |       |       | 25,275  |
| 1868              | 2,544  | 1,499 | 12,193 | 754    | 1,850  |       |        |        |       |       | 18,840  |
| 1869              | 4,765  | 1,714 | 20,355 | 8,854  | 3,787  | 830   | 2,430  |        |       |       | 42,685  |
| 1870              | 1,812  | 290   | 12,714 | 7,262  | 2,810  |       |        |        |       |       | 24,888  |
| 1871              | 115    | 312   | 16,790 | 10,123 | 4,420  | 627   |        |        |       |       | 32,387  |
| 1872              | 896    | 226   | 8,559  | 7,335  |        | 1,950 | 2,000  |        |       |       | 15,466  |
| 1873              |        |       | 6,309  | 8,246  | 4,407  |       |        |        |       |       | 18,962  |
| 1874              |        |       | 1,756  | 4,133  | 1,073  |       |        |        |       |       | 6,962   |
| 1875              |        |       |        | 1,010  | 1,150  |       |        |        |       |       | 2,160   |
| 1877              |        |       |        |        | 392    |       |        |        |       |       | 392     |
| 1880              |        |       |        |        |        | 1,888 |        |        |       |       | 1,888   |
| Taken up in 1884, | 13,272 | 8,485 | 98,288 | 61,782 | 43,582 | 6,445 | 10,765 | 19,561 | 1,980 | 1,056 | 265,216 |
|                   |        |       | 546    | 2,159  |        |       | 1,005  | 1,556  |       |       | 5,266   |
| Total ft.         | 13,272 | 8,485 | 97,742 | 59,623 | 43,582 | 6,445 | 9,760  | 18,005 | 1,980 | 1,056 | 259,950 |
| " miles           | 2.51   | 1.61  | 18.51  | 11.29  | 8.25   | 1.22  | 1.85   | 3.41   | .38   | .20   | 49,233  |

HIGH SERVICE MAIN PIPE.

|              | 2 in. | 4 in. | 6 in.  | 8 in. | 10 in. | 12 in. | 16 in. | 20 in. | Feet.  | Miles. |
|--------------|-------|-------|--------|-------|--------|--------|--------|--------|--------|--------|
| Main Line,   |       |       |        |       |        | 2,845  | 20,470 | 13,801 | 37,116 | 7.03   |
| Iron Pipe,   | 334   | 4,595 | 6,617  | 6,908 | 6,292  | 2,592  | 2,262  |        | 29,600 | 5.60   |
| Cement Pipe, | 710   | 3,039 | 10,325 |       |        |        |        |        | 14,074 | 2.66   |

# TABLE B.

LENGTH AND SIZE OF PIPE LAID AND NUMBER OF GATES AND HYDRANTS SET DURING THE YEAR ENDING NOVEMBER 30, 1884.

| STREET.             | LOCATION.                                        | PIPE.   |              | No. of<br>Hyd'nts. | No. of<br>Gates. |               |
|---------------------|--------------------------------------------------|---------|--------------|--------------------|------------------|---------------|
|                     |                                                  | Size.   | Lgth. in ft. |                    |                  |               |
| Alvarado Avenue,    | From Anna Street north.                          | 8       | 1658.        | 3                  | 1                |               |
| Anna Street,        | " Locust to Coburn Avenue.                       | 8       | 811.         | 2                  | 1                |               |
| Asylum Street,      | " Mulberry Street west.                          | 4       | 189.         |                    | 1                | High Service. |
| Bloomington Road,   | " Grafton Street east.                           | 8       | 1016.        |                    | 1                |               |
| "                   | " Grafton Street east.                           | { 4 38. |              |                    |                  |               |
| "                   | " Putnam Court to Plantation Street.             | 6       | 609.         | 1                  | 2                | High Service. |
| Bradley Street,     | " Washington Street to Gold Street Court.        | 8       | 1600.        | 3                  |                  |               |
| Brussels Street,    | At Pakachoag Mills.                              | 6       | 422.         | 2                  | 1                |               |
| Burncoat Street,    | From Lincoln Street north.                       | 6       | 680.         | 1                  | 1                |               |
| Camp Street,        | " Cambridge Street to St. John's Cemetery.       | 6       | 924.         | 2                  | 2                |               |
| Canterbury Street,  | " Grand Street south.                            | 8       | 1287.        | 2                  | 1                |               |
| Clifton Street,     | Between May and Oberlin Streets.                 |         |              | 1                  |                  |               |
| Coburn Avenue,      | From Anna Street north.                          | 6       | 1114.        |                    | 1                |               |
| Crompton Street,    | " Anna Street south.                             | 8       | 178.         | 2                  | 1                |               |
| E. Bloomington Rd., | " Chelsea Street to Woodward Street.             | 6       | 625.         | 1                  | 1                |               |
| Eastern Avenue,     | " Plantation Street to Locust Avenue.—Lake View. | 8       | 3051.        | 2                  | 2                |               |
| Foster Street,      | At Farwell Street.                               |         |              |                    | 1                |               |
| Front Street,       | From Summer Street to Bridge Street.             | 8       | 490.         | 1                  | 2                |               |
| Ingalls Street,     | " Trumbull Street to Hibernia Street.            | 12      | 1005.        | 5                  | 9                |               |
| Jacques Avenue,     | " Vernon Street to Fox Street.                   | 4       | 556.         |                    | 2                |               |
| Locust Avenue,      | " Piedmont Street east.                          | 6       | 800.         |                    | 1                |               |
| Madison Street,     | " Wor. and Shrewsbury R. R. to Anna Street.      | 8       | 442.         | 2                  | 1                |               |
| Main Street,        | " Main Street to Southbridge Street.             | 12      | 502.         | 1                  | 2                |               |
| Millbrook Street,   | " Chandler Street to Front Street.               | 20      | 1556.        | 6                  | 16               |               |
| Orchard Street,     | " End of pipe east to Chas. Wilder's.            | 4       | 707.         | 1                  | 1                |               |
| Pleasant Street,    | " Belmont Street to Bismark Street.              | 6       | 425.         | 1                  | 1                |               |
|                     | " Bloomington Road to B. & A. R. R.              | 6       | 1780.        | 3                  | 1                |               |
|                     | " Chandler Street east—Tatnuck.                  | 12      | 1515.        | 2                  | 1                |               |

TABLE B.—CONTINUED.

| STREET.             | LOCATION.                                | PIPE. |              | No. of Hyd'nts. | No. of Gates. |               |
|---------------------|------------------------------------------|-------|--------------|-----------------|---------------|---------------|
|                     |                                          | Size. | Lgth. in ft. |                 |               |               |
| Providence Street,  | From Grafton Street to Harrison Street.  | 8     | 1502.        | 4               | 2             |               |
| Putnam Court,       | " Shrewsbury Street to Bloomingdale.     | 8     | 1177.        | 1               | 2             |               |
| Richland Street,    | " end of Pipe west.                      | 6     | 324.         | 1               |               |               |
| Ripley Street,      | " Ripley Street Place to Beacon Street.  | 6     | 378.         | 1               |               |               |
| Silver Street,      | " May Street to Claremont Street.        | 4     | 478.         |                 | 2             |               |
| Southbridge Street, | " College Street south.                  | 6     | 261.         |                 |               | High Service. |
| Thorn Street,       | " Wall Street east.                      | 6     | 260.         |                 | 1             |               |
| Union Avenue,       | Between Vernon Street and Ward Street.   |       |              | 1               |               | High Service. |
| Union Street,       | At Foster Street.                        | 8     | 3248.        | 4               | 1             |               |
| Vernon Street,      | From Union Avenue to J. S. Perry's.      |       |              | 1               | 1             |               |
| West Boylston St.,  | At Rawson's Factory.                     |       |              | 1               |               | High Service. |
| Woodland Street,    | Between May Street and Kingsbury Street. |       |              |                 |               |               |
| Woodward Street,    | From Crompton Street southwest.          | 2     | 161.         |                 |               |               |
|                     | Totals,                                  |       | 30,959.      | 59              | 62            |               |
|                     | PIPE TAKEN UP.                           |       |              |                 |               |               |
| Bloomingdale,       | From Grafton Street east.                | 4     | 1016.        |                 | 1             | High Service. |
| Eastern Avenue,     | " Farwell Street to Belmont Street.      | 6     | 657.         |                 |               |               |
| Front Street,       | " Trumbull Street to Hibernia Street.    | 12    | 1005.        | 6               | 2             |               |
| Main Street,        | " Chandler Street to Front Street.       | 16    | 1556.        | 6               | 5             |               |
| Providence Street,  | " Grafton Street to Harrison Street.     | 6     | 1502.        | 4               | 2             |               |
| Putnam Court,       | " Shrewsbury Street south.               | 6     | 286.         |                 | 1             |               |
| Ripley Street,      | " Ripley Street Place west.              | 4     | 62.          |                 |               |               |
|                     | Totals,                                  |       | 6,084.       | 16              | 11            |               |

**TABLE C.**  
**SERVICE PIPES LAID TO NOVEMBER 30, 1884.**

|               | FOR CITY.  |        | FOR INDIVIDUALS. |        | No.  |
|---------------|------------|--------|------------------|--------|------|
|               | Feet.      | Miles. | Feet.            | Miles. |      |
| Prior to 1865 | 3,800      | .719   |                  |        | 139  |
| 1865          | 5,979.83   | 1.132  | 3,588.67         | .672   | 207  |
| 1866          | 8,592.39   | 1.627  | 7,980.95         | 1.502  | 284  |
| 1867          | 11,281.46  | 2.127  | 12,938.01        | 2.45   | 388  |
| 1868          | 18,237.24  | 2.507  | 11,843.59        | 2.148  | 504  |
| 1869          | 17,958.14  | 3.401  | 12,855.87        | 2.435  | 673  |
| 1870          | 11,403.95  | 2.160  | 11,562.01        | 2.19   | 581  |
| 1871          | 10,089.36  | 1.911  | 9,149.6          | 1.738  | 504  |
| 1872          | 7,444.75   | 1.41   | 6,811.           | 1.29   | 357  |
| 1873          | 6,004.91   | 1.187  | 7,241.           | 1.371  | 315  |
| 1874          | 4,773.83   | .904   | 6,009.5          | 1.138  | 231  |
| 1875          | 4,171.25   | .79    | 5,568.75         | 1.055  | 215  |
| 1876          | 2,368.     | .448   | 2,345.17         | .444   | 104  |
| 1877          | 2,976.33   | .564   | 3,679.67         | .697   | 147  |
| 1878          | 3,207.33   | .607   | 3,354.66         | .635   | 151  |
| 1879          | 3,790.08   | .718   | 4,355.33         | .824   | 181  |
| 1880          | 5,237.5    | .992   | 6,132.91         | 1.161  | 229  |
| 1881          | 6,894.33   | 1.211  | 7,372.66         | 1.49   | 331  |
| 1882          | 7,358.     | 1.488  | 11,632.17        | 2.203  | 377  |
| 1883          | 9,237.10   | 1.749  | 12,315.10        | 2.332  | 459  |
| 1884          | 9,807.5    | 1.857  | 14,897.42        | 2.821  | 458  |
|               | 155,563.28 | 29.459 | 161,534.04       | 30.591 | 6825 |

#### SERVICE PIPE.

Eleven applications were received from last year and 462 made during the present year. 458 were laid and fifteen remain to be acted upon. The expense to the city was \$5,247.86, or an average of \$11.46 each, to individuals \$5,798.74, an average of \$12.66 each. Some parties have done their own trenching and the cost is unknown. 5,720 feet, or in 34 cases, temporary mains have been laid, 204 services have been drilled out and repaired on cement pipe at the main at an average cost of \$1.42. Thirty-three stop boxes have been replaced by iron ones. In twenty-six cases galvanized service pipes have been taken out and cement lined laid. Very few of these now remain of the smaller sizes. During the year twenty elevators have been connected with the

works, ten on the high and ten on the low service. Total number connected with the works eighty-eight. Of which thirty-nine are on the high and forty-nine on the low service. Number of freight elevators seventy-five, passenger thirteen.

### METERS.

There have been 464 new meters set. Total number on the works 5,638. 499 new and 658 repaired meters have been tested. Meters have been repaired at an average cost of \$3.53 each for all sizes.

| KINDS.        | SIZES.        |               |       |                     |       |       |       |       |       | TOTAL. |
|---------------|---------------|---------------|-------|---------------------|-------|-------|-------|-------|-------|--------|
|               | $\frac{1}{8}$ | $\frac{1}{4}$ | 1 in. | 1 $\frac{1}{2}$ in. | 2 in. | 3 in. | 4 in. | 6 in. | 8 in. |        |
| Union, Piston | 1,475         | 292           | 57    | 7                   | 14    | ..    | 1     | ..    | ..    | 1,846  |
| Union, Rotary | 2,502         | 127           | 50    | 28                  | 74    | 16    | 5     | 1     | 1     | 2,804  |
| Desper . . .  | 926           | 36            | 2     | ..                  | ..    | ..    | ..    | ..    | ..    | 964    |
| Crown . . .   | 5             | ..            | ..    | ..                  | 1     | 1     | ..    | ..    | ..    | 7      |
| Gem . . .     | 9             | ..            | 1     | ..                  | 1     | ..    | 8     | ..    | ..    | 14     |
| Worthington   | ..            | 8             | ..    | ..                  | ..    | ..    | ..    | ..    | ..    | 8      |
|               | 4,917         | 458           | 110   | 35                  | 90    | 17    | 9     | 1     | 1     | 5,638  |

### CITY METERS.

| KINDS.                  | SIZES.        |               |       |                     |       |       |       |       |       | TOTAL. |
|-------------------------|---------------|---------------|-------|---------------------|-------|-------|-------|-------|-------|--------|
|                         | $\frac{1}{8}$ | $\frac{1}{4}$ | 1 in. | 1 $\frac{1}{2}$ in. | 2 in. | 3 in. | 4 in. | 6 in. | 8 in. |        |
| Union, Piston . . . . . | 8             | 85            | 45    | 9                   | 18    | ..    | ..    | ..    | ..    | 160    |
| Union, Rotary . . . . . | 47            | 54            | 37    | 21                  | 70    | 16    | 4     | 1     | 1     | 251    |
| Crown . . . . .         | ..            | ..            | ..    | ..                  | 1     | 1     | ..    | ..    | ..    | 2      |
| Gem . . . . .           | ..            | ..            | 1     | ..                  | 1     | ..    | 2     | ..    | ..    | 4      |
|                         | 55            | 139           | 83    | 30                  | 85    | 17    | 6     | 1     | 1     | 417    |

TABLE D.

LENGTH AND SIZE OF PIPE LAID AND NUMBER OF GATES AND HYDRANTS PUT IN TO NOVEMBER 30, 1884.

|                | 2 in.     | 3 in.    | 4 in.      | 5 in. | 6 in.      | 8 in.     | 10 in.    | 12 in.    | 16 in. | 18 in. | 20 in. | 24 in. | 30 in. | Miles.  | Gates. | Hyd'ts |
|----------------|-----------|----------|------------|-------|------------|-----------|-----------|-----------|--------|--------|--------|--------|--------|---------|--------|--------|
| Prior to 1864  |           |          |            |       |            |           |           |           |        |        |        |        |        |         |        |        |
| 1864           |           |          | 19,697     | 2,822 | 12,674     | 6,159     |           | 7,166     | 13,809 | 1,980  | 1,056  |        |        | 7,642   | 36     | 152    |
| 1865           | 144       |          | 4,197      |       | 3,744      | 68        |           | 886       | 2,255  |        |        |        |        | 5,968   | 12     | 65     |
| 1866           | 982       |          | 8,946      |       | 6,269      | 5,769     |           |           | 2,915  |        |        |        |        | 5,248   | 49     | 36     |
| 1867           | 2,564     | 3,487    | 10,211     |       | 1,624      | 11,266    |           |           | 2,915  |        | 273    |        |        | 6,165   | 43     | 56     |
| 1868           | 2,194.8   | 3,487    | 8,964      |       | 2,197      | 8,402     |           | 1,474     | 1,874  |        |        |        |        | 5,89    | 57     | 35     |
| 1869           | 5,123.6   | 2,540.5  | 14,586.57  |       | 3,206      | 1,860.5   |           |           |        |        |        |        |        | 4,427   | 47     | 45     |
| 1870           | 1,469     | 2,312.25 | 20,428.53  |       | 10,642.53  | 4,102.97  | 1,004.16  | 2,725     |        |        |        |        |        | 8,796   | 109    | 29     |
| 1871           | 840       | 865.5    | 14,745     |       | 9,835      | 3,791.5   |           |           |        |        |        |        |        | 5,626   | 64     | 39     |
| 1872           | 421       | 345      | 19,110     |       | 10,052     | 5,690     | 627       |           |        |        |        |        |        | 6,949   | 80     | 89     |
| 1873           |           | 226      | 4,420.25   |       | 7,307      |           | 2,032     |           | 8,916  |        | 13,801 |        |        | 7,534   | 42     | 9      |
| 1874           |           |          | 5,786.75   |       | 9,714      | 5,691     |           | 2,845     | 11,554 |        |        |        |        | 6,781   | 46     | 35     |
| 1875           |           |          | 3,068.91   |       | 6,170      | 5,948     |           | 3,724     | 8,380  |        |        |        |        | 5,167   | 37     | 26     |
| 1876           |           |          | 562        |       | 2,257.25   | 1,150     |           |           | 3,534  |        |        |        |        | 1,421   | 49     | 28     |
| 1877           |           |          | 1,122.25   |       | 140.75     |           |           | 4,819     |        |        |        | 700    |        | 1,284   | 28     | 19     |
| 1878           | 211       |          | 349.5      |       | 919        | 1,086.5   |           | 8,016     | 1,029  |        | 56     |        |        | 1,222   | 21     | 18     |
| 1879           | 311.25    |          | 326        |       | 666        | 2,222     |           | 3,197     |        |        |        |        |        | 1,254   | 11     | 9      |
| 1880           |           |          | 1,178.25   |       | 3,337.25   | 597       |           |           |        |        |        |        |        | 1,026   | 9      | 11     |
| 1881           | 324       |          | 972.75     |       | 3,997.5    | 1,812     | 5,898     | 1,045.75  |        |        |        |        |        | 2.6     | 15     | 22     |
| 1882           |           |          | 3,927      |       | 5,161.5    |           | 99        | 1,711     |        |        |        |        |        | 2.18    | 28     | 25     |
| 1883           | 150       |          | 3,603      |       | 2,617      | 13,286    | 1,722     | 2,813     | 2,262  |        |        |        |        | 4.32    | 22     | 43     |
| 1884           | 161       |          | 1,110      |       | 11,957     | 1,982     |           | 527       |        |        |        |        |        | 7.17    | 29     | 28     |
|                |           |          | 1,913      |       | 8,052      | 16,255    |           | 3,023     |        |        |        |        |        | 5.868   | 62     | 59     |
| Total,         | 14,411.65 | 8,276.25 | 149,158.76 | 2,822 | 122,029.78 | 96,078.47 | 14,837.16 | 41,626.75 | 55,478 | 1,980  | 21,088 | 11,414 | 7,060  | 108,323 | 889    | 789    |
| Pipe taken up  | 409       | 281      | 15,146     | 1,835 | 14,411     | 2,898     | 2,058     | 2,541     | 1,886  |        |        |        |        | 7,757   | 40     | 28     |
| Total in feet, | 14,002.65 | 7,955.25 | 134,012.76 | 1,487 | 107,618.78 | 93,180.47 | 12,779.16 | 39,085.75 | 53,592 | 1,980  | 21,088 | 11,414 | 7,060  |         |        |        |
| Miles,         | 2,632     | 1.51     | 25,831     | .382  | 20,382     | 17,647    | 2.42      | 7,402     | 10,15  | .375   | 8,938  | 2.16   | 1.34   | 95,634  | 849    | 761    |

## REPAIRS.

The cost of repairs of leaks has been very heavy for material used, for damages, the repair of streets, &c. This excess over previous years is very largely accounted for by the increased pressure on street mains. This makes the breaks greater, and by reason of this and the increased pressure itself, deliver a greater quantity of water, washing streets rapidly and more liable to injure private property. A table of the number and cost of leaks for the past and for the last four years follows:

EXPENSE AND AVERAGE COST OF REPAIRING LEAKS IN 1884.

|                       | HIGH SERVICE. |          |       | LOW SERVICE. |          |        | TOTAL. |          |        |
|-----------------------|---------------|----------|-------|--------------|----------|--------|--------|----------|--------|
|                       | No.           | Cost.    | Avg.  | No.          | Cost.    | Avg.   | No.    | Cost.    | Avg.   |
| Cement .....          | 27            | 462.30   | 27.12 | 78           | 2,251.73 | 28.87  | 105    | 2,714.03 | 25.85  |
| Damages, Cement ..... |               |          |       | 9            | 1,971.00 | 219.00 | 9      | 1,971.00 | 219.00 |
| Iron .....            | 20            | 480.17   | 24.01 | 4            | 22.89    | 5.75   | 24     | 503.16   | 20.96  |
| Hydrants .....        | 8             | 56.11    | 18.70 | 8            | 26.27    | 8.76   | 6      | 82.38    | 13.73  |
| Gates .....           | 1             | 18.75    | 18.75 | 1            | 4.16     | 4.16   | 2      | 17.91    | 8.95   |
| Service .....         |               |          |       | 15           | 71.18    | 4.74   | 15     | 71.18    | 4.74   |
|                       | 51            | 1,012.33 | 19.85 | 101          | 4,347.33 | 43.04  | 152    | 5,359.66 | 35.26  |

EXPENSE AND AVERAGE COST OF REPAIRING LEAKS FROM NOVEMBER 30, 1881, TO DECEMBER 1, 1884.

|               | 1881. |          |        | 1882. |          |       | 1883. |          |       | 1884. |          |        |
|---------------|-------|----------|--------|-------|----------|-------|-------|----------|-------|-------|----------|--------|
|               | No.   | Cost.    | A'ge.  | No.   | Cost.    | A'ge. | No.   | Cost.    | A'ge. | No.   | Cost.    | A'ge.  |
| Cement .....  | 96    | 2,455.85 | 25.58  | 57    | 1,168.53 | 20.50 | 97    | 1,741.25 | 18.16 | 106   | 2,714.03 | 25.85  |
| Iron .....    | 16    | 214.70   | 13.42  | 21    | 286.97   | 12.71 | 25    | 284.00   | 15.36 | 27    | 608.45   | 18.86  |
| Service ..... | 26    | 124.97   | 4.80   | 27    | 131.50   | 4.87  | 25    | 121.55   | 4.86  | 15    | 71.18    | 4.74   |
| Damages ..... | 6     | 1,733.10 | 288.85 | 2     | 21.00    | 10.50 | 3     | 255.00   | 85.00 | 9     | 1,971.00 | 219.00 |
|               | 138   | 4,528.62 | 32.82  | 106   | 1,588.00 | 15.12 | 147   | 2,521.90 | 17.16 | 152   | 5,359.66 | 35.26  |

Of the leaks during the past year, I think we have had none where the pressure is less than 60 pounds. They have occurred on 76 different streets. The pressure on the low service has been kept to the maximum most of the time, both day and night, not dropping off more than two or three pounds during the

heaviest draft, and has been ten to fifteen, and in some localities twenty or twenty-five pounds, higher than formerly. A great deal of the cement pipe has been laid 15 to 20 years, and considering the price of cast iron at the time it was laid, has no doubt paid for itself, and has proved the principal factor in the ability of the city to furnish its citizens with water at a less price than almost any city or town in the country, and has contributed very largely to the growth and prosperity of the city. Many localities have outgrown the original pipes. Great improvements have been made in the making of cast iron pipe in the meantime, and it is now furnished at a reasonable price and of good quality. The expense of maintenance must be large for some time to come, as the cost of replacing cement pipe is charged to that account, and, in fact, so long as the present and past rapid growth of the city and works continue.

The pipes crossing Mill Brook sewer at Winter, Temple and Franklin streets were laid below the bed of the stream. When the sewer was lowered the pipes were cut off, and after completion were carried through the open arches, openings being cut for the purpose. They were boxed and well protected from freezing.

RAINFALL AT LYNDE BROOK RESERVOIR FOR TEN YEARS ENDING  
NOVEMBER 30, 1884.

|                | 1875  | 1876  | 1877  | 1878  | 1879  | 1880  | 1881  | 1882  | 1883  | 1884  | Totals |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| December . . . | 1.66  | 1.09  | 2.64  | 1.26  | 5.82  | 8.95  | 2.32  | 4.46  | 1.94  | 1.76  | 26.90  |
| January . . .  | 2.85  | 2.25  | 1.79  | 4.91  | 1.34  | 2.99  | 3.61  | 3.12  | 2.24  | 4.89  | 29.99  |
| February . . . | 3.62  | 4.25  | .37   | 3.35  | 3.00  | 2.76  | 4.71  | 2.87  | 3.61  | 5.06  | 33.60  |
| March . . . .  | 3.10  | 7.82  | 7.03  | 3.89  | 3.22  | 2.41  | 5.46  | 2.87  | 1.46  | 4.91  | 42.17  |
| April . . . .  | 2.36  | 2.91  | 1.99  | 6.11  | 3.67  | 2.75  | 1.87  | 1.47  | 1.60  | 3.55  | 28.08  |
| May . . . .    | 2.44  | 2.94  | 1.90  | 1.36  | 1.64  | 1.86  | 4.43  | 5.09  | 4.85  | 2.94  | 29.45  |
| June . . . .   | 3.77  | 1.55  | 2.14  | 4.30  | 3.06  | 2.62  | 4.58  | 2.35  | 2.90  | 2.91  | 30.18  |
| July . . . .   | 4.92  | 6.97  | 3.84  | 2.77  | 3.88  | 3.80  | 2.88  | 1.25  | 2.99  | 3.73  | 42.03  |
| August . . .   | 3.04  | 1.52  | 4.04  | 3.88  | 5.29  | 4.07  | 2.04  | .94   | 1.12  | 3.59  | 34.53  |
| September . .  | 3.78  | 3.91  | .48   | 1.20  | 1.72  | 2.07  | 2.50  | 9.24  | 1.57  | .84   | 27.31  |
| October . . .  | 5.78  | 1.81  | 3.42  | 4.16  | .95   | 3.85  | 3.20  | 2.18  | 4.97  | 2.15  | 37.47  |
| November . . . | 4.79  | 3.88  | 7.07  | 6.05  | 2.37  | 1.77  | 3.77  | .85   | 1.51  | 2.11  | 34.17  |
| Totals . . . . | 47.11 | 40.90 | 41.71 | 43.24 | 35.96 | 39.90 | 41.17 | 36.69 | 30.76 | 38.44 | 395.88 |

The rainfall for the year as taken at the Lynde Brook Reservoir has been 38.44 inches, or 1.14 inches less than the average for ten years, and makes the third consecutive dry year.

The street plans showing mains, gates and hydrants have been nearly completed to the present year's work. These will be completed to date early the present winter. It will then be very little work to each year make the necessary additions and corrections.

The pumping station at New Worcester has been discontinued, the boilers sold and the pumps are in the hands of the makers for sale. The pipes and special castings taken up and all property belonging to the city removed from the premises. The building was hardly worth removing and was left for the owner of the land, Mr. Coes. The premises have been cleared and graded to his satisfaction. As soon as it can be done the Holden and Leicester Reservoirs should be connected with the Commissioner's office by telephone. For the better control of the supply this should be done the coming year.

The department is very much in need of a barn, additional store-room and a better place for blacksmith shop and pipe lining room. The lot fronting on School street would be an excellent place for a building suitable for the use of the Department. During the past year, with its many and varied duties, the Commissioner has found no idle time on his hands. The days being only too short for the work to be done.

The value of the stock and tools on hand is \$38,924.14, a good stock of 4", 6", 8" and 12" pipe, and special castings is on hand.

Number of bills rendered City Treasurer for collection, 1826, amounting to \$23,368.71; 283 bills, amounting to \$3,807.89, remain uncollected Nov. 30, 1884. Amount of abatements \$291.29.

Financial statement for the year ending Nov. 30, 1884.

#### CONSTRUCTION.

|                |                   |
|----------------|-------------------|
| Appropriation, | \$35,000 00       |
| Revenue,       | 23,460 78         |
| Total,         | <hr/> \$58,460 78 |

# REPORT OF WATER COMMISSIONER.

33

## EXPENDED.

|                                                  |             |
|--------------------------------------------------|-------------|
| For Salaries and clerk hire,                     | \$2,809 99  |
| “ Labor,                                         | 14,689 82   |
| “ Meters and repairs of same,                    | 11,567 86   |
| “ Gates, valves and hydrants,                    | 8,863 68    |
| “ Iron pipes,                                    | 16,619 14   |
| “ Castings,                                      | 444 05      |
| “ Horse hire,                                    | 72 50       |
| “ Transportation,                                | 79 14       |
| “ Travelling expenses,                           | 67 02       |
| “ Lead and lead pipe,                            | 1,861 92    |
| “ Powder, exploders, &c.,                        | 532 99      |
| “ Iron, steel and tools,                         | 161 82      |
| “ Pipe, fittings, &c.,                           | 2,863 37    |
| “ Cement pipe, &c.,                              | 59 65       |
| “ Paints, oil, &c.,                              | 11 12       |
| “ Telephone, stationery, stamps, &c.,            | 35 08       |
| “ Trucking, freight and express,                 | 629 88      |
| “ Lumber and carpenter work,                     | 45 72       |
| “ Rubber goods and cordage,                      | 29 26       |
| “ Fire clay,                                     | 13 05       |
| “ Paving,                                        | 16 25       |
| “ Coal,                                          | 15 37       |
| “ Suction hose and repairs of pumps,             | 87 31       |
| “ Damages,                                       | 4 00        |
| “ Plumbing,                                      | 14 44       |
| <hr/>                                            |             |
| Amount,                                          | \$55,598 38 |
| Balance unexpended, transferred to Sinking Fund. | 2,867 40    |

## LAKE VIEW.

Appropriation, \$17,500 00

## EXPENDED.

|                       |             |
|-----------------------|-------------|
| For Labor,            | \$4,989 58  |
| “ Pipe,               | 8,775 80    |
| “ Castings,           | 659 17      |
| “ Hydrants and Gates, | 762 10      |
| “ Lead,               | 466 66      |
| “ Trucking,           | 209 80      |
| “ Transportation,     | 74 06       |
| <hr/>                 |             |
| Total,                | \$15,886 67 |
| Balance unexpended,   | 1,613 38    |

## REPORT OF WATER COMMISSIONER.

## NEW SUPPLY.

|                                   |                    |
|-----------------------------------|--------------------|
| Balance unexpended Nov. 30, 1883, | \$27,331 39        |
| Appropriation,                    | 100,000 00         |
| Revenue,                          | 864 86             |
| Total,                            | <hr/> \$128,196 25 |

## EXPENDED.

|                                |                   |
|--------------------------------|-------------------|
| For Labor,                     | \$5,592 32        |
| “ Teaming and Trucking,        | 2,021 20          |
| “ Iron pipe,                   | 4,901 99          |
| “ Tools, &c.,                  | 21 50             |
| “ Transportation,              | 427 70            |
| “ Clerical work,               | 33 75             |
| “ Castings, &c.,               | 218 10            |
| “ Gates and hydrants,          | 1,001 28          |
| “ Engineering,                 | 1,680 40          |
| “ Horse hire,                  | 115 50            |
| “ Paving,                      | 240 28            |
| “ Pipe and labor,              | 74 54             |
| “ Blacksmithing,               | 44 46             |
| “ Lumber and carpenter work,   | 453 02            |
| “ Sand and cement,             | 230 45            |
| “ Grass seed,                  | 32 16             |
| “ float gauge and screens,     | \$104 90          |
| “ Insurance and taxes,         | 14 34             |
| “ Paints, oils, &c.,           | 37 59             |
| “ Examining titles, fees, &c., | 20 11             |
| “ Use of pump,                 | 30 00             |
| “ Damages personal injury,     | 50 00             |
| “ Land and land damages,       | 22,895 00         |
| Total,                         | <hr/> \$40,240 59 |
| Balance unexpended,            | 87,955 66         |

## MAINTENANCE.

|                                           |             |
|-------------------------------------------|-------------|
| For Labor,                                | \$15,917 71 |
| “ Salaries,                               | 1,400 48    |
| “ Clerical labor,                         | 741 00      |
| “ Canvassing,                             | 532 50      |
| “ Care of reservoir,                      | 99 99       |
| “ Meters and repairs,                     | 1,031 71    |
| “ Engineering,                            | 88 58       |
| “ Hardware and tools and repairs of same, | 228 79      |
| “ Iron pipe and freight,                  | 3,890 26    |
| “ Castings,                               | 1,070 15    |

|                                        |                   |
|----------------------------------------|-------------------|
| For Blacksmithing,                     | 122 80            |
| “ Lumber and carpenter work,           | 329 41            |
| “ Rubber goods,                        | 81 57             |
| “ Lantern globes, oil, &c.,            | 135 44            |
| “ Coal and wood,                       | 45 36             |
| “ Gas,                                 | 27 17             |
| “ Printing and advertising,            | 244 24            |
| “ Trucking, express and telegrams,     | 648 28            |
| “ Stationery, charts, stamps, &c.,     | 263 56            |
| “ Rent of telephone,                   | 74 00             |
| “ Pipe, sand and cement,               | 226 64            |
| “ Damages by breaks,                   | 1,971 00          |
| “ “ “ pumping,                         | 5,789 15          |
| “ “ “ blasting,                        | 23 16             |
| “ Harnesses, blankets and repairs,     | 78 10             |
| “ Hay, grain and straw,                | 434 59            |
| “ Taxes in Leicester,                  | 84 68             |
| “ “ Holden,                            | 244 97            |
| “ Horse hire,                          | 228 75            |
| “ Abatements,                          | 287 27            |
| “ Gates, hydrants and repairs of same, | 626 04            |
| “ Packing and cordage,                 | 95 47             |
| “ Pipe and fittings,                   | 809 55            |
| “ Brushes, brooms, &c.,                | 2 75              |
| “ Paints and oils,                     | 45 06             |
| “ Plumbing,                            | 33 25             |
| “ Traveling expenses,                  | 157 21            |
| “ Wagons and repairs,                  | 283 95            |
| “ Repair of boiler,                    | 162 10            |
| “ Transportation,                      | 10 70             |
| “ Furniture,                           | 25 00             |
| “ Paving,                              | 102 63            |
| “ Gravel,                              | 75 00             |
| “ Lawn seed,                           | 36 30             |
| “ Insurance,                           | 11 00             |
| “ Legal fees,                          | 109 00            |
| “ Brick and mason work,                | 15 75             |
| “ Iron signs,                          | 25 86             |
| “ Refreshments, 4                      | 10 00             |
| “ Clipping horse,                      | 2 00              |
| “ Cleaning gauge, &c.,                 | 11 64             |
| Total (paid from water rates),         | <hr/> \$38,886 06 |

In concluding, the Commissioner can but thank each one of the Committee for their kindness, forbearance and cordial co-operation in the manifold duties of his new and untried position.

I must also thank the Water Registrar for assistance in all matters pertaining to the many details of the Department. To his clerk the Commissioner is under especial obligations, and will say her services are invaluable to the city.

Respectfully submitted.

LUCIAN A. TAYLOR,

*Water Commissioner.*

WORCESTER, *December 17, 1884.*

# REPORT

## OF THE

# WATER REGISTRAR.

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*To the Joint Standing Committee on Water :*

GENTLEMEN :—In compliance with the requirements of Section 8 of the Ordinance relating to Water, I herewith submit my first Annual Report.

Four hundred and sixty-five applications for water were received during the year, and turned over to the Commissioner.

Bills for water have been rendered to the City Treasurer for collection, as follows :

|                           |                |                          |              |
|---------------------------|----------------|--------------------------|--------------|
| For Metered Water . . . . | 10,721 . . . . | amounting to \$92,514 81 |              |
| Annual Rates . . . .      | 1,985 . . . .  | “ “                      | 19,107 89    |
| Total,                    | 12,706         |                          | \$111,622 20 |

The amount of revenue received from water rates for the financial year was \$107,515.27.

The amount of uncollected bills in the hands of the City Treasurer, December 1st, 1884, was \$11,650.05.

The amount appropriated from Water Rates to Sinking Funds was \$44,256.77.

The water was shut off from the premises of six (6) takers on account of non-payment of bills. Five settled and the water was turned on ; one remains shut off.

During the year the sum of \$4,075.31 has been deducted from the amount charged for water rates and metered water, owing to changes from annual to metered rates, adjustment of bills of water takers, special contracts, and by votes of the Committee.

The quantity of measured water furnished during the twelve months ending September 30th, 1884, inclusive of water used for street watering, waste and leakage, was as follows:

|                                              |                   |
|----------------------------------------------|-------------------|
| From October, 1883, to April, 1884 . . . . . | 330,866,777       |
| " April, 1884, to October, 1884 . . . . .    | 249,637,550       |
| Total,                                       | <hr/> 480,504,327 |

#### METERS.

During the year there have been placed upon the works four hundred and sixty-five (465) meters, making at the present time five thousand six hundred and thirty-eight (5,638) in use.

My predecessor had for several years, in his Annual Report, recommended the establishment of a minimum rate. Early in the year the City Council passed an order establishing such rate at four dollars per year, payable two dollars in April and October of each year. This order went into effect on our October bills. Very little complaint has been made; most of our citizens express the opinion that the sum is low enough.

The wisdom of adopting this rule, I think, will be apparent to every one who is in the least familiar with the subject. I am of the opinion, that, in the near future, you will find it necessary to charge a minimum rate for all families over two in number, covered by one meter.

#### REVENUE.

The revenue for the past year does not show as marked an increase as I had reason to expect at the beginning of the year.

This is owing to the following reasons: 1st. By vote of the Committee the Registrar was authorized to make special contracts with six of our largest consumers, at a reduction of 33½ per cent. from their former rates; 2nd. We have a large num-

ber of tenements assessed by rate; owing to the general depression in business, these have been vacant three months or more, and by our rules were entitled to an abatement for the time vacant. 3*d*. From the same cause, most of our manufacturing establishments have been running with much less than their usual complement of hands, and very many of them on short time, consequently using much less metered water, thereby reducing our revenue from that source. 4*th*. By vote of the Committee a reduction of  $33\frac{1}{3}$  per cent. from former rates was made to parties using city water for sprinkling streets. This, with a season of frequent showers, has caused a falling off in the use of water for the above named purpose, from 16,577,100 gallons used last year to 12,019,500 gallons used this year, thereby reducing our revenue from this source alone \$1,284.53.

#### HAND HOSE.

I desire to call the Committee's attention to the frequent complaints made at this office, caused by the use of hand hose for washing windows and sidewalks, particularly on Main and Front streets. In most cases this work is performed by boys, regardless of the rights of passers, who are liable to get a thorough sprinkling, and frequently wet feet, from the perfect flood of water running over the walk. This is very annoying, particularly to ladies, who, by their employment, are obliged to be out between the hours of seven and eight A. M. I would respectfully suggest a change in the rule, allowing the use of hand hose not later than seven, A. M., from April 1st to November 1st. This, I think, will do away with the cause for complaint.

#### STAND PIPES.

It has been the custom of the Water department to allow stand pipes, erected by individuals and corporations on their premises, to be connected with the city water pipes, to be used in case of fire only, without any expense to the individual or corporation, for water so used. Instances have come to my knowledge during the past year where this privilege has been constantly abused;

parties having such stand pipes attach long lines of hose to them and sprinkle streets about their premises. Some rule should be adopted to stop this abuse.

#### COLLECTION OF WATER BILLS.

While the collection of bills does not belong to this department, still in a measure it is responsible for the same, for if bills are not paid in thirty days after notice from the Treasurer that the bills are in his hands ready for payment, this department is required to send an additional notice to delinquents, to the effect that if the bills are not paid in five days the water will be shut off. This rule, if strictly enforced, often operates unjustly to some parties ; for instance, where, as in some cases, four parties are on the same supply pipe, three pay, and the fourth neglects to do so,—under our present rule, all are shut off until such time as the delinquent sees fit to pay his bill. Under this rule, it seems to me, that we are liable to do an injustice to some citizens, who are willing and prompt to pay their bills. I find that in almost every other city and town having water works, that if bills are not paid in thirty days interest is charged, and at such a high rate that it insures prompt payment of water bills. I simply throw out these suggestions for the consideration of the Committee, not being prepared to recommend any particular change.

#### CANVASS OF THE WATER TAKERS OF THE CITY.

On assuming the office of Water Registrar, I was informed by my predecessor (Mr. Brown) that no complete canvass of the water takers of the city had been taken for the past ten years, and that he had contemplated recommending to the Committee that one be made the present year, as the department had no means of knowing the number of persons using city water. Acting upon the suggestion of Mr. Brown, I recommended to the Committee that a canvass be made. Early in March, by vote of the Committee, authority was given this department to cause such canvass to be made. Work was commenced immediately, and completed in June.

As a result of the canvass we find that there are 5,264 dwellings, 11,570 families, and 51,298 persons using city water.

We found a large number of places that had not been assessed for several years. We also found places where the pipe had been tapped behind the meter. I am of the opinion that a canvass should be made every year, and that a suitable person be employed by this department to do the work, being fully convinced that his salary would be saved many times over.

#### PLUMBERS.

During the first part of the year I called the attention of the Committee to the Ordinance in relation to Plumbers. I am of the opinion that so long as we are without an ordinance compelling all plumbers doing business in the city to be licensed, just so long we shall have defective plumbing, thereby causing waste of water, and a never-ending amount of trouble to the department.

While the regular plumbers seem disposed to make correct returns to this office, we have a large class of persons in our community somewhat acquainted with plumbing, who are ready to do any kind of work that may be wanted, and conceal the same from the water department. By changing the form of plumbers' returns, I have somewhat improved the condition of things, still it is far from satisfactory.

#### REMARKS.

I have found during the past year that most people, however unreasonable when they visit the office with complaints, are finally disposed to listen to reason and accept the explanation for their cause of complaint. The friction between the department and water takers has been much less than I had anticipated.

Respectfully submitted.

GEORGE E. BATCHELDER,

*Water Registrar.*



REPORT OF CITY ENGINEER  
TO THE  
COMMITTEE ON WATER.

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CITY OF WORCESTER, CITY ENGINEER'S OFFICE,

December 20th, 1884.

*To the Joint Standing Committee on Water :*

GENTLEMEN :—In accordance with Section 1, Chapter 17, of the City Ordinances, the City Engineer submits the following report :—

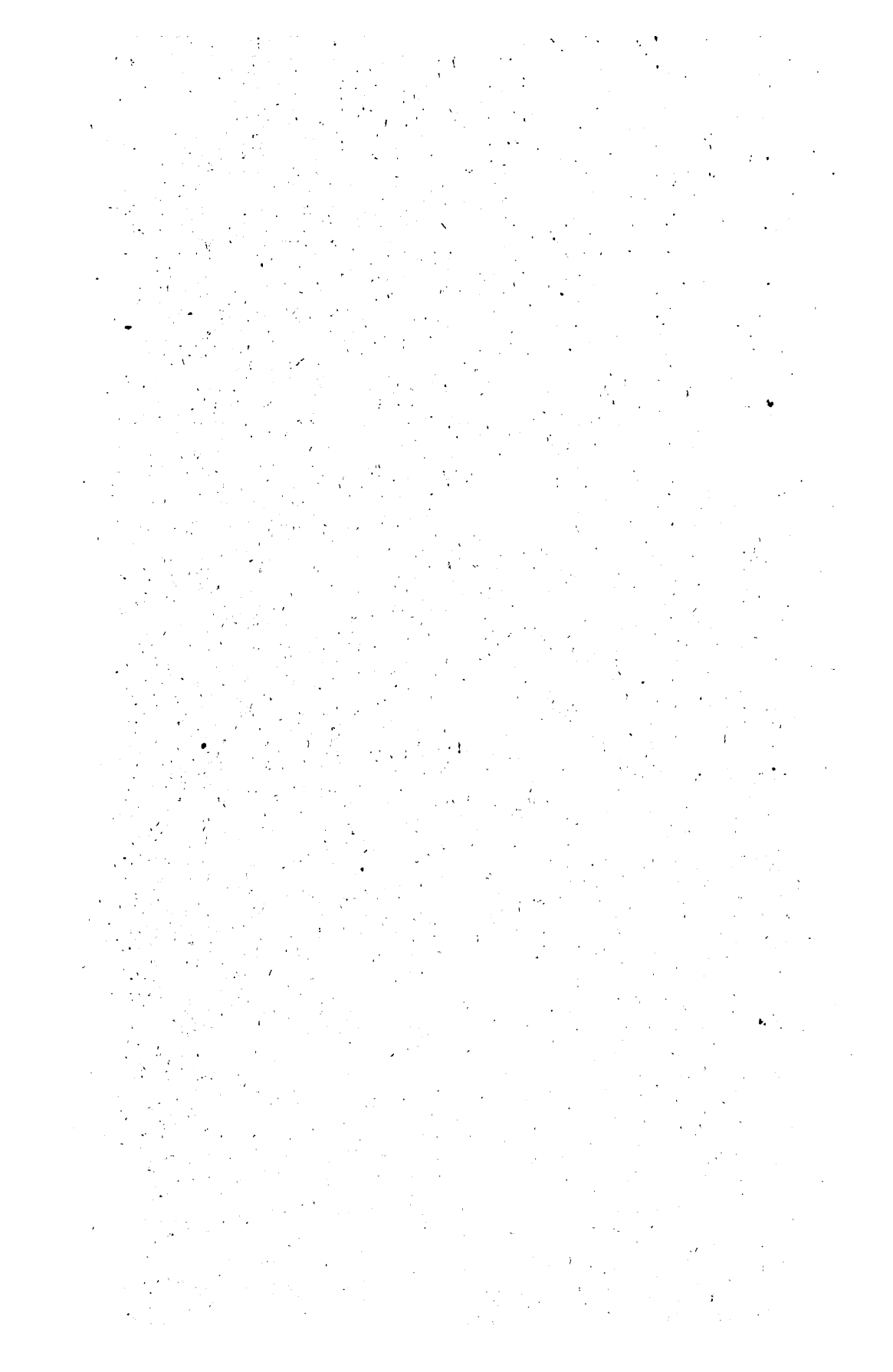
The reservoirs at Leicester and at Holden have been visited by me frequently during the past year, and I believe the dams to be in good condition. The dam at Holden has been much improved in appearance by the grading done there by the Water Commissioner. A careful survey and cross section of the Holden Reservoir has been made and its capacity calculated. The figures are so arranged that by reference to the tables prepared the amount of water stored is shown for any given depth of water in the pond. The capacity of the Leicester Reservoir was calculated in a similar manner when it was first constructed, so that it is now possible to ascertain the amount of water stored for use at any time. Measurements have also been made of the amount of water wasted at both reservoirs during the year. As the facilities for making accurate measurements are somewhat limited, and as it is a matter of great importance to the city to know

just how much water is furnished by the water-sheds that is not used, I recommend that suitable weirs for measuring the water be placed in the streams below the dams, so that more accurate results can be arrived at. A series of measurements and experiments have also been made to ascertain the amount of water drawn per day from the reservoirs for use in the city and what proportion of this amount is returned to the stream through the sewers. The results are as follows: Average amount drawn, 3,419,394 gallons per day; average amount returned to stream, 2,230,852 gallons per day, or 65 per cent. In conclusion, I would say that I consider the water supply of this city one of the best in New England. The additional supply obtained last year was provided none too soon. In fact, there is no doubt but that pumping would have had to be resorted to through the past summer and fall if the new works had not been constructed.

Respectfully submitted.

CHARLES A. ALLEN,

*City Engineer.*







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